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ON THE DISEASES OF THE KIDNEY AMENABLE TO SURGICAL TREATMENT.

GLASGOW:
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LECTURES

TO

PRACTITIONERS.

ON THE DISEASES OF THE KIDNEY

AMENABLE TO SURGICAL TREATMENT.

[illegible]

BY

DAVID NEWMAN, M.D.,

SURGEON TO THE WESTERN INFIRMARY (OUT-DOOR DEPARTMENT); PATHOLOGIST TO AND LECTURER
ON PATHOLOGY AT THE GLASGOW ROYAL INFIRMARY; EXAMINER IN PATHOLOGY
IN THE UNIVERSITY OF GLASGOW; VICE-PRESIDENT GLASGOW
PATHOLOGICAL AND CLINICAL SOCIETY.

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PREFACE.

In an abbreviated form the contents of this volume constituted part of a combined course of post-graduate Lectures, delivered in Glasgow during the autumn of 1886, by Professor W. T. Gairdner, Dr. Joseph Coats, and the author. The two former have already published their Lectures conjointly.

Early in his professional career the author devoted considerable attention to the study of the functions of the kidney from the physiological, and of diseases of the kidney from the histological and medical standpoints, while at a later date he approached the subject from the surgical side, and in 1883 published a monograph on movable kidney which now forms the bulk of the first Lecture.

The subject of these Lectures was suggested by the clinical observation of a number of cases, which, with a careful study of preparations contained in the Museums of the Royal and Western Infirmaries of Glasgow (those in the latter prepared and described by Dr. Joseph Coats), formed a basis of personal experience. The clinical cases and Museum specimens are frequently referred to in the text, and it may here be added that in the two Museums mentioned, there is an exceptionally large and varied collection of interesting and in some instances unique preparations illustrative of the subject.

As a preparation for these Lectures an endeavour was made to bring together a complete collection of operations upon the kidney. With this aim a circular was addressed to surgeons, asking them to fill up an accompanying schedule giving certain details of their cases. In response to this appeal, not only was the subsequent history of a large number of published cases supplied, but also returns were made of many private operations performed at home and abroad. For this assistance the author desires to express his appreciation and thanks.

Within recent years statistics of renal operations have been published by Kroner, Czerny, Quénu, Bolz, Billroth, and Jong, but no attempt has been made to publish complete and detailed statistics in English since 1882, when Harris brought forward his collection of one hundred cases of nephrectomy. The general results of private investigations have been produced in American Medical and Surgical Journals, but these records are necessarily unsatisfactory, and it is extremely difficult to verify the observations, the only references given being the names of the operators.

Previous to the delivery of these Lectures, the facts relating to over five hundred operations upon the kidney were collected by the author, a number which does not include over two hundred cases of perinephritic abscess mentioned, but not detailed in this volume. Since then forty-one new cases have been incorporated, twenty-six of which are taken from Brodeur's work, *De l'Intervention Chirurgicale dans les Affections du Rein*, published at the end of 1886.

The delay of two years in publishing the Lectures has been due, to a considerable extent, to the professional engagements of the author, and partly to the time occupied by an enquiry into the etiology of acquired hydronephrosis, which entailed a search through six hundred and sixty-five cases distributed in published records, in hospital reports, and in museums. The results of this enquiry are given in the second Lecture.

It is needless to refer to the scope of these Lectures, as this information is given in the table of contents.

In compiling the tables of statistics the author has given the references to his sources of information, and has stated them as being private only in those instances in which he has been unable to discover a published record.

Before concluding this prefatory note, it is the pleasant duty of the author to gratefully acknowledge his indebtedness to his friends and colleagues, Dr. George S. Middleton, and Dr. John Lindsay Steven, for their valuable suggestions and careful revisal of the proof sheets while passing through the press; also to his assistant, Dr. D. M'Kellar Dewar, for his preparation of the index, and to Dr. G. N. Kreider, of Illinois, for verifying a few cases reported in American Medical Journals to which the author had not access.

WOODSIDE PLACE,
GLASGOW, *October*, *1888*.

CONTENTS.

LECTURE I.

PAGES

Malpositions of the Kidney, ... 1-76

Introduction. Distinction between medical and surgical diseases of kidney. Dawn of renal surgery. Simon's experiments. Nomenclature of operations.

MALPOSITION OF THE KIDNEY AND ITS VARIETIES.— Displacement of Kidney without Mobility: its statistics and varieties—cases. Case of fused kidney.

Temporary or Permanent Displacement with Mobility: synonyms. Distinction between movable and floating kidney. Cases of floating kidney.

Normal Kidney: anatomy and relationships.

Movable Kidney: statistics; pathological anatomy; etiology; relative frequency. Cases of movable kidney observed by author. Its predominance in females; relation to menstruation; frequency on right side — Landau's theory. The liver and its relations to movable kidney, and the effect of diseases of generative organs in producing it. Symptoms of movable kidney; movable tumour; gastric and hepatic disturbance; urinary anomalies. Cases of transitory hydronephrosis, and one of torsion and occlusion of blood-vessels in movable kidney. Physical signs of movable kidney. Diagnosis from enlarged gall-bladder, small ovarian tumours, tumours of mesentery and omentum, movable spleen, and from tumour of the colon and fœcal masses. Treatment of movable kidney; by bandages and trusses; by constitutional means; by operation. Table of nephrectomies for movable kidney. Nephrorraphy or nephrectomy?

Floating Kidney: always a congenital condition—case: importance surgically; impossible to distinguish it from movable kidney by physical examination.

LECTURE II.

PAGES

GENERAL SYMPTOMATOLOGY OF THE DISEASES OF THE KIDNEY WHICH ARE AMENABLE TO SURGICAL TREATMENT, . 77-102

SYMPTOMATOLOGY OF KIDNEY DISEASE. HÆMATURIA.—Physical examination of the urine and blood clot; blood from urethra, bladder, kidney. Author's apparatus for estimating the quantity of hæmoglobin in solution. Diagnosis of cause of hæmaturia; renal calculus; tumour; tubercular disease; injury to kidney—case.

PYURIA.—Pus from urethra; bladder; kidney. Source of renal pyuria; inflamed pelvis or calices; calculous pyelitis. The urine in strumous kidney; in cystic disease.

SIGNIFICANCE OF PAIN IN RENAL REGION: in hydronephrosis; in cystic disease; in pyelitis; in perinephritic abscess; in strumous disease; in calculus.

SIGNIFICANCE OF SWELLING IN RENAL REGION.—Diagnosis between enlargement of kidney and ovarian cyst; ascites; perinephritic abscess; hepatic cysts and solid tumours of liver; splenic growths; enlargement of lymphatic glands; fœcal accumulations and perityphlitic abscess.

Character of the fluid contents in various accumulations; hydronephrosis; ascites; hydatid, ovarian, and parovarian cysts.

LECTURE III.

DISEASES CHARACTERISED BY ACCUMULATIONS OF NON-INFLAMMATORY FLUID, ... 103-163

HYDRONEPHROSIS.—CONGENITAL HYDRONEPHROSIS: its Causes—Illustrative Cases.

ACQUIRED HYDRONEPHROSIS: etiology and pathology—cases. Some of the causes of hydronephrosis:—tumours of the pelvic organs; stricture of the urethra; hypertrophy of prostate and bladder; tumour or abscess causing torsion of ureters; displacement of female pelvic organs; bands and adhesions; renal calculus; displacement of kidney leading to torsion of ureter; tubercular disease of bladder; tumour of bladder; other causes. Cases illustrative of the foregoing causes. Table showing causes. Circumstances determining the degree of hydronephrosis; transitory and complete obstruction. Author's experiments. Cause of atrophy of renal tissue. The fluid in

hydronephrosis. Case of transitory hydronephrosis. Physical signs of hydronephrosis: its symptoms. Diagnosis from cancer of kidney and cystic degeneration. Prognosis.

CYSTIC DISEASE OF KIDNEY: SIMPLE CYSTS AND CYSTIC DEGENERATION—illustrative cases—pathology. Symptoms of cystic disease—case—pathology.

HYDATID OR OTHER PARASITIC DISEASE: etiology and pathology —cases—symptoms; physical signs; diagnosis; prognosis.

CONGENITAL CYSTS: causes—cases.

Treatment—

of hydronephrosis; by manipulation—Bennett's case—by repeated tapping; by nephrotomy; by nephrectomy. Table of operations for hydronephrosis.

of cystic disease medicinally and by operation. Table of operations.

of hydatids medicinally and by operation.

Table of nephrotomies for hydronephrosis and cystic disease.

Table of nephrectomies for hydronephrosis and cystic disease.

LECTURE IV.

PAGES

DISEASES CHARACTERISED BY SIMPLE INFLAMMATORY CHANGES, WITH ACCUMULATION OF INFLAMMATORY PRODUCTS, . 165-277

SUPPURATIVE DISEASES OF THE KIDNEY.—Definitions of terms used in kidney inflammations.

PYELITIS.—Case: etiology of non-calculous pyelitis: micrococci, gonorrhœa, specific fevers, irritant poisons, &c., as causes.

URINARY CALCULI: Tables of collected specimens showing composition, structure of calculi, and mode of formation.

RENAL CALCULUS; its causes. Uric acid infarction. Effects of calculus on renal pelvis and substance.

PYONEPHROSIS: etiology and pathology.

PYELONEPHRITIS: classification of causes—case: histological changes in kidney: modes of infection by uriniferous tubules, and by lymphatics of cortex.

PURULENT INTERSTITIAL NEPHRITIS: etiology—case: as a result of infective disease. A unique case of a foreign body causing suppurative disease of kidney.

Perinephritic Abscess: etiology when primary and secondary—cases: pathology.

Pyelitis: symptoms and diagnosis: condition of urine with regard to blood, pus, and renal cells.

Pyelonephritis: symptoms: diagnosis from suppurative nephritis.
Prognosis in pyelitis, pyelonephritis, and suppurative nephritis.

Pyonephrosis: signs, symptoms, and diagnosis.

Perinephritic Abscess: symptoms and diagnosis. Duration and termination of pyonephrosis and perinephritic abscess.

Renal Calculus: symptomatology and diagnosis: diagnosis of varieties of renal calculus: of unilateral or bilateral disease.

Pyelitis: treatment by medical and surgical means.

Pyonephrosis: treatment similar in many respects to that of hydronephrosis or renal calculus.
Table of nephrotomies for suppurative disease without calculus.
Table of nephrectomies for suppurative disease without calculus.

Pyelonephritis and Acute Suppurative Disease: treatment dependant on cause. Prophylaxis against pyelonephritis: treatment when established.

Perinephritic Abscess: treatment, medically and surgically.

Renal Calculus: treatment depending on various circumstances: prophylactic: symptomatic: symptoms justifying operation. Operative treatment.
Table showing results of nephro-lithotomies for calculus with suppuration.
Table of nephro-lithotomies for renal calculus without suppuration.
Table of nephro-lithotomies for calculus with suppurative disease of kidney.
Table showing results of nephrectomies for suppurative disease with calculus.
Tables for contrasting the results of nephrotomy, nephro-lithotomy, and nephrectomy, for suppurative disease with and without calculus.
Table of nephrectomies for suppurative disease with calculus.

LECTURE V.

PAGES
Tubercular Disease of and Injuries to the Kidney, . 279-346

INFECTIVE NEW FORMATIONS: their place in pathological nomenclature.

Tubercular Disease of Kidney: acute miliary tuberculosis and scrofulous kidney.

Miliary Tuberculosis: pathology; always associated with tubercular disease of other parts.

Scrofulous Kidney: pathology; condition of bladder, &c., in—cases. Statistics of tubercular kidney. Primary tuberculosis, etiology; physical signs; the urine in. Detection of tubercular bacillus in urinary *débris* with cases. Symptoms of tubercular kidney similar to suppurative pyelitis. Diagnosis of tubercular kidney; from calculous pyelitis and malignant disease. Prognosis. Nephrotomies for tubercular disease. Nephrotomy or nephrectomy? Nephrectomies for tubercular disease.

INJURIES OF THE KIDNEY AND URETER: their classification; causes.

Bruises and Lacerations of the Kidney: varieties and their results. Mr. Godlee's case. Symptoms of bruise and rupture; hæmaturia—curious case; swelling in flank; suppression of urine; shock, &c. Instructive case. Prognosis in renal lacerations.

Penetrating Wounds of Kidney, with or without prolapse of organ—cases; results; diagnosis—Mr. Lloyd's case; symptoms depend on mode of production. Cases of rupture of ureter without penetrating wound giving rise to pseudo-hydronephrosis. Cases of wounds of the ureters by the knife. Gunshot wounds of the ureters—case. Renal fistulæ. Treatment of bruises and lacerations in the early stages—Mr. Bennet May's case—Dr. Rawdon's case; treatment in the latter stages; nephrotomy and nephrectomy.

Table of nephrotomies for tubercular disease; of nephrectomies for the same. Table of nephrotomies and nephrectomies for traumatic lesions, urinary fistulæ, &c.

LECTURE VI.

PAGES

Renal Non-Inflammatory Neoplasms—Operations on the Kidney, ... 347-457

TUMOURS OF KIDNEY.

What is a tumour? Recent classifications of tumours. Difficulties of classification. Histological classification: clinical; benign and malignant.

Fibromata and fibrocystic tumours and their varieties—cases.

Osteomata: tumours of doubtful occurrence.

Lipomata: their varieties—cases. Fatty transformation of kidney—case.

Hæmatangiomata.

Adenomata.

Papilloma—a unique case.

Carcinomata: statistics of ages at which cancer shows itself. Primary cancer of kidney: its varieties; its origin and mode of extension. Encephaloid and scirrhous with cases. Renal epithelioma a rare disease—cases. Colloid cancer—cases. Cylindromata. Secondary formations following upon primary cancer of kidney—case.

Lymphadenoma—case.

Sarcomata: Dr. Windle's summary; table of ages at which found. Congenital tumours—cases. Spindle-celled sarcoma cases. Adeno-sarcoma—cases. Alveolar sarcoma—case. Angio-sarcoma—cases. Myxo-sarcoma—cases. Myo-sarcoma—case.

General remarks on the etiology of malignant disease; influence of age.

Duration and prognosis of tumours of kidney. Duration of malignant growths. Diagnosis of tumours of kidney; of benign and malignant growths; of carcinoma from sarcoma.

Treatment of malignant growths.

Table of nephrectomies for cancer and sarcoma.

OPERATIONS ON THE KIDNEY:

For diagnostic purposes:—

Compression of Ureter: by various methods. Dr. Polk's and Dr. Tuchmann's methods. Description of Silbermann's instrument.

Catheterisation of Ureter: the author's electric endoscope and ureter catheters; method of using them.

For diagnostic and remedial purposes:—

Aspiration and Puncture of Kidney: points to be attended to; results.*

For remedial purposes:—

Nephrotomy: diseases for which called; aims of the operation; site of the incision; description of the operation. Table showing the lesions for which nephrotomy has been performed, and the results of the lumbar and abdominal operations.

Nephro-lithotomy: circumstances demanding it; for calculus with or without suppuration. Lumbar nephro-lithotomy; details of operation; points to be attended to. Abdominal nephro-lithotomy—Mr. Thornton's method. Little risk to life in nephro-lithotomy for calculus without suppuration. After-treatment.

Nephrectomy: diseases in which called for. Table of diseases for which it has been performed, and the results of the lumbar, abdominal, and combined operations. Median-abdominal, lateral-abdominal, and lumbar operations, with the advantages and disadvantages of each. Table of the causes of death in 120 fatal cases of lumbar and abdominal nephrectomy. Lumbar nephrectomy; details of the operation. Two methods of abdominal nephrectomy; details of both.

Nephrorraphy: for movable kidney only; steps in the operation.

Table of nephrectomies for tumours of the kidney.

LECTURES TO PRACTITIONERS.

ON THE DISEASES OF THE KIDNEY AMENABLE TO SURGICAL TREATMENT.

LECTURE I.

Introductory remarks. The nomenclature of operations. Malpositions of the kidney, including displacements with and without mobility. Distinctions between movable and floating kidney. General consideration of the anatomical relationships, pathological anatomy, etiology, and relative frequency of movable kidney, which abnormality is shown to be predominantly frequent in mothers of large families. The other causes of most importance; emaciation and displacement of generative organs. Relative frequency on right side. The symptomatology illustrated by cases. Physical signs; diagnosis; treatment by bandages, trusses, and by operation. Floating kidney.

In the course of lectures which we begin to-day, it is my purpose to direct your attention to the diseases of the kidney amenable to surgical treatment. On glancing over the records of the Royal and Western Infirmaries, I find that the great majority of patients admitted to these Institutions suffering from the diseases we are about to consider, have been placed under the care of the physician rather than of the surgeon, notwithstanding that in many instances medical treatment is useless, and the only chance of cure consists in early surgical interference. The explanation of this is easy. Seeing that his disease affects

5

one of the internal organs, the patient naturally looks to the physician for relief. One can easily understand why such affections as tubular, or chronic interstitial nephritis, or amyloid infiltration, lesions involving the secreting structure of the organs, should be treated from beginning to end as medical cases. On the other hand, all will admit that such complaints as movable kidney, renal affections secondary to diseases of the lower urinary tract, or tumours of the kidney, should be claimed by the surgeon. Diseases such as those just mentioned are easily relegated to their proper departments, and, conventionally speaking, designated "medical" or "surgical" diseases of the kidney. But what are we to say of that considerable group of cases indicated by serious symptoms, of which the diagnosis is not clear, careful examinations having led different observers to diverse opinions as to the locality of the lesion, or its nature? A disease thus difficult to identify in its early stage, even after keen observation, and analysis of the symptoms and physical signs, may, at a later period, develop, and be assigned, either to the province of the physician, or of the surgeon. Therefore, one who desires to form a correct diagnosis in the view of operative interference, must be familiar with the very intimate relations existing between the various parts of the urinary system. In other words, the surgeon must not only be thoroughly acquainted with his own special sphere, but he must also have a knowledge of that which is conventionally assigned to the physician.

The classification of diseases of the kidney into surgical and medical, must be admitted to be a very arbitrary one, and the placing of a case into one or other division must largely depend upon the individual opinion of the professional attendant, and whether or not the patient is willing to submit to surgical treatment. Without invading the sphere of the physician, the surgeon is rapidly coming to his assistance, and widening his own field of operations. But while this is so, the surgeon must depend upon the physician, or upon the general practitioner, who, in the majority of instances, has the first care of the patient, to recognise the cases likely to be benefited by surgical interference.

It is only by a careful study of what has already been done in the sphere of renal surgery, that one can arrive at a reliable opinion. For this purpose, I have collected statistics, both from published cases and from private sources, and these I shall make use of when we come to speak of the operations which should be performed under different circumstances. Systematic operations upon the kidney have only been resorted to within a comparatively short time—not more than 15 or 20 years. Doubtless, previous to that time, abscesses of renal origin pointing in the groin were opened, and, in a few instances, calculi, having been discovered by means of the probe, were removed. But it is only with the experience of the last few years that operators have felt warranted in removing, or even in exploring, a kidney.

Mr. Thomas Smith, in a paper read before the Royal Medical and Chirurgical Society of London, in 1869, was one of the first who seriously suggested the operation of nephrotomy for the removal of calculus; and about the same time, Simon of Heidelberg, and Czerny, by their successful operations for the relief or cure of disease of the kidney, gave an enormous impetus to systematic operative interference, and established its claim as a recognised surgical procedure of high value.

Simon's article must be regarded as the starting point in any discussion on the subject of renal surgery, and a consideration of the facts which induced him to resort to extirpation of the kidney for the relief of disease, must always be of special interest to the practical surgeon.

A distressing case of urinary fistula, resulting from ovariotomy, having come under his care, and all resources having failed to relieve the suffering of the patient, the advisability of extirpating the kidney suggested itself. Before, however, such an operation could be resorted to, it was necessary to ascertain whether or not it was consistent with life to *suddenly withdraw* the function of one kidney, and throw the entire labour upon the other organ. Pathological records afforded him many instances in which one kidney had been gradually rendered functionally useless, by *slowly progressing disease*, and where compensatory hypertrophy had gradually become established without disturbance to the economy. But whether or not *sudden* withdrawal of one kidney would be tolerated had still to be proved by experiment upon animals. For the purpose of clearing up this point, he performed 15 nephrectomies upon dogs, and found—(1) that the greatest risk of death was from peritonitis; (2) that primary and secondary hæmorrhage were less to be feared than he anticipated; (3) that pyæmia and embolism were not met with in a single case; (4) that the effect upon the elimination of the renal excreta was not such as to lead to symptoms of uræmia; (5) no albuminuria or hypertrophy of the heart resulted from the operation; and (6) the remaining healthy kidney within a short time increased in size, and was soon competent to perform the double duty suddenly imposed upon it.

These results encouraged Professor Simon to perform the first nephrectomy designed upon definite physiological principles. His case, and many of those since performed, have, by their success, demonstrated the accuracy of his observations and conclusions.

Previous to this, as will be seen by reference to the statistics, renal operations were performed with very varying success, and in many of the earlier ones the procedure was entered upon in the belief that the disease was not of renal, but of ovarian origin.

The kidney may be operated upon in various ways, according to the nature of the disease and the object the surgeon has in view. The pathological conditions calling for surgical interference are numerous and varied. For the relief of hydronephrosis, pyonephrosis, or other accumulations of fluid in the substance of the kidney, ASPIRATION or PUNCTURE may be sufficient; but in other instances the fluid may reaccumulate, and render it necessary to make an incision into the kidney structure. To this operation the term NEPHROTOMY should be applied, and, for statistical purposes, it should be limited to cases in which an incision has been made, but no calculus removed. When an incision is made down upon, and into the kidney, with the express purpose of removing a stone therefrom, the operation should be designated NEPHRO-LITHOTOMY. When a patient's life is seriously threatened by disease, and when all other modes of treatment have failed, the more formidable operation, extirpation of the kidney, may be performed, either by the abdominal incision, ABDOMINAL NEPHRECTOMY, or by the operation in the lumbar region, LUMBAR NEPHRECTOMY. Again, in cases of floating kidney, or of movable kidney, with the purpose of fixing it in position, the displaced organ may be exposed, and stitched to the edges of the wound in the parietes. This operation is called NEPHRORRAPHY.

In the last lecture of this course, I shall endeavour to show you the procedure by which these operations are performed, indicate the conditions regulating the choice of an operation, and the dangers attending each. In this, and the intervening lectures, it is my purpose to occupy your attention by glancing at the pathology, symptoms, and diagnosis of the various maladies which call for operative treatment; and I shall illustrate the subject as far as possible by reference to cases, statistics, and specimens.

The first morbid condition which comes up for discussion is

Malposition of the Kidney.

At the present time there is great diversity of opinion in regard to the pathological importance and therapeutic indications of misplaced kidney, and more particularly when the misplacement is associated with mobility of the organ. The majority of observers regard cases where the kidneys are permanently fixed in an abnormal situation merely as anatomical curiosities of no clinical importance; but when the organ floats free in the abdomen, and gives rise to serious symptoms, it is not an uncommon occurrence to find that the surgeon considers the life of the patient so much in danger that he does not hesitate to extirpate the kidney. In regard to the latter condition, two extreme views are held, by Keppler on the one hand, and Landau on the other. The former considers that a movable or floating kidney should be excised as soon as it is detected, and regards it as a continual source of danger to the patient; while the latter goes so far as to say that death does not result from this condition, and that in no case is nephrectomy justifiable. Between these two opinions there is plenty of room for discussion.

Displacements of the kidney may be divided into three kinds—simple misplacement, without mobility of the organ; "movable kidney," where the kidney is perceptibly mobile behind the peritoneum; and "floating kidney," where the peritoneum forms a meso-nephron which attaches the kidney loosely to the spine.

Simple displacement of the kidney without mobility is by no means uncommon. Perhaps no organs in the body vary more in their position than the kidneys. Their relative distance from the spine, or their position in relation to other organs, is observed to vary considerably. For instance, without any evident cause, one may be found close up to the spleen, almost touching the diaphragm and vertebral column, while the other organ is situated considerably below the crest of the ileum, and removed some distance from the spine. From observations which I have made regarding this point, it seems clear that malposition of the kidney within certain limits, is of frequent occurrence, and may exist without causing any disturbance. In 1,000 *post-mortem* examinations 24 cases occurred where the position of one or both kidneys might be described as abnormal. In 9 of these cases there was also malposition of the suprarenal capsule. Malposition of the kidney does not, therefore, necessarily involve an alteration in the position of the suprarenal capsule, although the intimate anatomical relationship which exists between them might lead one to expect that any condition causing the kidney to occupy an anomalous position, would also cause a disturbance of the corresponding suprarenal body. One case was peculiar, and was the only instance where the displacement was very marked; in the others, the abnormality might have been overlooked had care not been taken to observe the exact position of the organs. In the case referred to, the right kidney was situated about half an inch to the right of the promontory of the sacrum, and the left in the iliac fossa, two inches to the left of the sacro-iliac synchondrosis. The right kidney was small in size, and so altered in shape that there was no hilus, and the ureter passed from the lower aspect of the organ. The tissue of the organ was normal in appearance, and the arteries, two in number, came off from the aorta about an inch above its bifurcation. The left kidney was normal in every respect, except in its position. There was no evident cause for the abnormality; the other abdominal organs were practically normal, and there was no indication of inflammatory, or other mischief within the abdomen.

Here is another similar preparation removed from the body of a man, aged sixty-one, who died of erysipelas in the Royal Infirmary. The right kidney was situated at the brim of the pelvis, half in the cavity, and half out. It forms a flattened oval body, of about the usual size of the kidney, and is supplied by two arteries, which pass off from the aorta in the middle line in front, just at the bifurcation. These vessels pass slightly to the right, but nearly directly downwards, and enter the kidney on its anterior aspect about a third down from the upper border. The arteries lie each in a separate groove as they pass along the upper third of the kidney, and the grooves demarcate a triangular piece of the organ. The right renal vein passes off from the vena cava, about an inch above the level of the bifurcation of the aorta, and passes directly downwards to enter the kidneys along with the arteries. The ureter also arises from the anterior aspect, and passing down in front has a somewhat tortuous course to the bladder, as if it was too long for the distance to be travelled. The right suprarenal capsule is in its normal position close under the liver. The right kidney was firmly fixed in its abnormal position. One other irregularity was discovered in the vessels; the inferior mesenteric artery came off just above the bifurcation of the aorta.

The left kidney was normal in all its relations.

Many such cases have been recorded. M. Aubé mentions a case where the left kidney was found between the common iliac arteries, close to their origin from the aorta. Pacoud narrates another, in which a kidney was found situated in the pelvis between the rectum and bladder, and somewhat similar instances have been described by Drouin, Bellini, Andral, Bonet, and others.

In my own cases, and in those referred to by these observers, alteration in form of the displaced organ seemed to depend on the situation occupied by it. For example, in M. Aubé's case the kidney was flattened, and its anterior surface divided into three parts by two depressions formed by the passage of two arteries. As a general rule, malpositions of the kidney are associated, particularly when the displacement is congenital, with some deviation from the normal in regard to the position of the large intestine and peritoneum, and, not uncommonly, the distribution and number of the blood-vessels and the course and length of the ureters are found to be abnormal. Roberts states that in twenty-one cases of congenital malposition of the kidney, which he was able to collect and compare, the abnormality was in every instance confined to one kidney: and the left kidney was much more commonly affected than the right (left 15, right 6). Most frequently the kidney was found lying obliquely on the sacro-iliac synchondrosis. In some cases the organ was fixed beside the uterus, or transversely between the rectum and the bladder, or across the prominence of the sacrum.

Dr. Butler has described and figured a curious and interesting case where the kidneys were united, or fused into one, with a central line or raphé making a longitudinal fissure over the surface of the organ, better marked on the posterior than on the anterior aspect. In length, they extended from the border of the fourth lumbar vertebra downwards over the promontory of the sacrum to the middle of that bone—in all, five inches; and in breadth, measured three and three-quarter inches. The ureters sprang from a pelvis, which occupied the centre of the anterior surface of the organs, and then passed off on each side, and discharged into the bladder at the usual sites. The arteries supplying the organs were four in number—above, a single large trunk came from the aorta, just at its bifurcation, immediately in front of the median sacral artery, and, passing downwards, before entering the substance of the kidney, broke up into five small branches; on the left side, two arteries came from the left internal iliac, near its origin; on the right side, an artery passed into the organ from the right internal iliac.

These remarkable cases of malposition of the kidney seldom give rise to serious symptoms, and generally escape observation during life. Cases, however, have been recorded where the misplaced kidney has been mistaken for an abdominal tumour, or, in the female, has from its position within the pelvis become a serious obstacle to parturition.

Besides being liable to congenital malposition, the kidneys may be displaced upwards, downwards, or laterally from the enlargement of other organs, such as the liver, spleen, suprarenal bodies, or pancreas, or from the pressure of tumours near them. When the right kidney is depressed by an enlarged liver, not an uncommon accident, it is most usually rotated on its short axis, so that the hilus is turned upwards, and the upper portion of the kidney is most depressed. Rayer mentions an instance where the right kidney was forced down by an enlarged suprarenal body, and cites a case of Hohl's, where a kidney, situated deeply on the inside of the psoas muscle, offered an obstacle to parturition by retarding the passage of the child's head.

The number of cases of fixed malposition of the kidney, now upon record, is very large. Most of them, however, were discovered after death, and only in a few instances was any inconvenience occasioned during life.

With these few remarks on simple misplacement of the kidney without mobility, an anomaly of pathological interest, but of little clinical significance, we now pass to the consideration of a malady of greater interest and importance to the general practitioner and gynæcologist.

Temporary or permanent displacement with mobility has been designated by various terms. To this pathological condition the older writers applied the name, "Dislocation of the kidney," "Displacement," "Ectopia," "Descent," and "Prolapse" of the kidney, while most modern authors speak of "Wandering kidney," "Floating kidney,". or "Movable kidney."

The terms, "movable kidney" and "floating kidney," are used by most writers as synonymous. It is necessary, however, carefully to distinguish between those two conditions in order to have a clear understanding of the pathology of the subject; and also, for the sake of treatment, it is well to have an exact mode of expression, and an accurate knowledge of the varieties of the malpositions which may be met with in practice.

In cases of "movable kidney" the organ is mobile behind the peritoneum, either within its adipose capsule, or in a sac formed between the peritoneum and the muscular wall of the abdomen, whereas, in cases of "floating kidney" the kidney moves about within the cavity of the peritoneum, and is attached by a mesentery to the spine.

The distinction here drawn between movable and floating kidney was adopted by Sir William Jenner, in his Clinical Lectures on the Diagnosis of Extra-pelvic Tumours of the Abdomen; he says—"I told you that the kidney is moved a little by the respiratory movements. Sometimes it can be moved by the hand, and this much more frequently than you would suppose. A movable kidney is one thing; a floating kidney is another. We very rarely see or feel a floating kidney. I have never met with one after death, though I have felt in a patient what has been supposed to be one. A floating kidney is a kidney that has a mesentery—a fold of peritoneum attaching it very loosely to the spine. A floating kidney, therefore, can be moved about to a considerable extent—to the extent of the length of its mesentery. A movable kidney can only be passed up and down a little; it slips a little under your fingers." In a report by a Committee of the Pathological Society of London, appointed to inquire into the matter of displaced, movable, and floating kidneys, the following passage will be found:—"Looking at the matter of kidneys unduly movable, we think it well to divide them into two varieties. The first form is that in which the organ may be moved to some extent beneath the peritoneum. A certain degree of this mobility is not very uncommon. It will be found to be present in a considerable number of subjects, if, as soon as the body is opened, the kidneys be handled without the removal of any of the organs. The amount of movement possible is not commonly greater than an inch or two upwards and downwards. Occasionally, however, a flaccidity of the peritoneum exists to a much greater extent, so as to allow the kidney to move under the peritoneum over a space, described in one of the reports sent to us as a circle having a diameter of eight or nine inches. In the second variety the peritoneum passes over the posterior surface of the kidney, forming a kind of meso-nephron.

"From the evidence which has been laid before us, it appears that these so-called floating kidneys may depend upon either of the above states; that the peritoneum may be flaccid and loose to such an extent as to allow the kidney to move under it, so as to come in contact with the wall of the belly; or to leave its natural place and pass to or below the brim of the pelvis; or, indeed, in some cases, to encroach upon the opposite side of the belly. A like movableness or floating of the kidney may be due to the presence of a meso-nephron, already spoken of. It will, therefore, be seen that the terms movable and floating kidney must not be used as strictly corresponding to two anatomical varieties, since a kidney without a meso-nephron may give rise to all the clinical phenomena shown by one with a meso-nephron. Both these anatomical varieties merge by insensible degrees into one another, and these two expressions, movable and floating, can only be used as implying different degrees of the diseased state, which, according to its extent, may give rise to a slightly mobile, or an extremely mobile kidney."

In the above statement there are several points to which we will refer hereafter.

There was considerable doubt thrown upon this subject by Mr. Lawson Tait in a short paper in the *British Medical Journal*, of November, 1882, where in reference to a case "pronounced to be a 'floating kidney' by several distinguished authorities," but which proved to be a distended gall bladder containing a large number of gall-stones, he said "I put the floating kidney altogether on one side; besides I have never seen such a thing, either in life or in a museum, nor have I met any one who has. In fact, I have no belief in its existence as a pathological incident." The truth of this rather bold statement was controverted shortly after in a letter by Dr. Seymour J. Sharkey, of London, who evidently understood Mr. Tait to refer in his paper to movable as well as floating kidney. Although Mr. Tait used the term "floating kidney" in his paper, there is no evidence in his remarks that he limited it to cases of undue mobility of the organ owing to the presence of a meso-nephron; it seemed rather that he wished to deny the possibility of both conditions. In a subsequent letter, however, he confines the term "floating kidney" "to the state in which the kidney moves by reason of the existence of a meso-nephron," and affirms that he has never seen, nor is there recorded, so far as he can discover, "any instance where, by reason of this kind of mobility, a 'movable kidney' has been an incident of any pathological importance."

Floating kidney is no doubt less common than movable kidney, but whether the peritoneum remains loose or becomes united around the kidney, does not in any way increase or diminish the pathological importance of the displacement, although from a surgical point of view the former must be regarded as more dangerous than the latter condition. Both varieties appear in certain cases to be equally troublesome to the patient. Several cases of floating kidney have been recorded. I may mention two of these, where it is distinctly stated that a meso-nephron was found to be present. Dr. William Henderson, in the *Medical Times and Gazette*, 1859, vol. ii, p. 501, states, in reference to a case of his, that, "on examining the abdomen, the right kidney was found to be perfectly movable, and was suspended, as it were, by a prolongation of the peritoneum enclosing the kidney, and forming a distinct mesentery, which allowed it to move in all directions."

That this case was not only of pathological, but also of clinical importance, is obvious from its history. "She still complained of the shooting pain occasionally passing through the abdomen, and which she referred to the tumour. These pains being entirely distinct from the constant pain caused by the diseased vertebræ, I was at that time led to suppose the tumour to be of a malignant nature, and probably connected with the mesentery or omentum. . . . The tumour at this time could not be discovered; and any effort on her part to cause it to protrude was attended by the same shooting pain passing through the abdomen."

Dr. Priestley has described a case, in the same journal for 14th March, 1857, p. 262, where, at the *post-mortem* examination, "the peritoneum was found reflected over the posterior surface of the kidney, giving it thus a mesentery, and allowing it very considerable motion in the right side of the abdomen"; and, in the *Glasgow Medical Journal* for October, 1883, Dr. J. Lindsay Steven narrates a case where there was a renal mesentery. "On proceeding to examine the abdomen in this case, the lower end of the right kidney was found projecting forwards quite through the intestines, so as to be visible without disturbing them. Upon seizing it, it was discovered to be freely movable in a radiating manner, the centre of movement corresponding to the attachment of the renal vessels, and that part of its internal border extending from them to its upper extremity. On turning aside the parts, the suprarenal capsule was seen in its normal situation immediately beneath the posterior border of the liver, and, on letting the kidney fall back into its normal situation, it was found to lie quite an inch and a half below the level of that organ. In the movements of the kidney the suprarenal capsule was not in the least affected, and that it was not at all dragged downwards was proved by the fact that, on removing it along with the kidney and abdominal vessels, a small portion of the liver remained adhering to it. In this case there was quite evidently a partially formed renal mesentery, its line of attachment corresponding to the upper half of the internal border, and a small area of the upper portion of the posterior surface of the kidney—the movements of the lower part of the organ being thus much more free than those of the upper. There was no peritoneal sac in which the organ was moving, as the peritoneum was very firmly adherent to the organ all round, except at the part where the mesentery passed off to attach the kidney to the posterior abdominal wall."

From the remarks quoted from Sir W. Jenner's lecture, it would appear that he bases his diagnosis between movable and floating kidney upon the amount of mobility observed. "A floating kidney can be moved about to a considerable extent—to the extent of the length of its mesentery. A movable kidney can only be passed up and down a little, it slips a little under your fingers." The Committee of the Pathological Society also used the degree of mobility as a means of distinguishing between the two conditions, although they were aware that an equal amount of movement may result from either state. The clinical distinction may be difficult, but as far as the anatomy is concerned, the two varieties are easily and clearly separated from one another. The importance of discriminating between the one variety and the other is all the greater when operative interference is contemplated. In the case of the movable kidney the organ may be got at from behind, without opening the cavity of the peritoneum, whereas in floating kidney (where there is a meso-nephron), the kidney lies within the cavity, and cannot be reached without entering the peritoneum.

In the following remarks care will be taken to distinguish the two forms by their proper terms.

We will now limit our attention to the etiology, pathology, physical signs and symptoms, diagnosis, and treatment of *movable kidney.*

If the condition of the kidneys, as regards mobility, be observed in a large number of bodies, a certain degree of movement, sometimes amounting to two or three inches, will be found to be not uncommon. The peritoneum in many cases, particularly in women who have borne large families, is very flaccid, and its union with the posterior abdominal wall is but slight; and if, in addition to the loosening of the attachment of the peritoneum, the normal adipose tissue surrounding the kidneys has become atrophied, more or less movement of the organs may be permitted. The right kidney is more liable than the left even to slight disturbance. This is probably due to the fact that normally the right kidney is not bound down so firmly to the abdominal wall as the left. This movement seldom exceeds an inch and a half, but to this extent it is very common. Slight movement of the kidney is not of great importance, unless in so far as a study of the causes of it may throw some light upon the etiology of the graver forms.

Before considering in detail the etiology and pathology of these conditions, a few remarks regarding the topographical anatomy of the kidney may not be out of place. The kidneys are placed on either side of the vertebral column, on a level with the last dorsal and upper two or three lumbar vertebræ, the right organ being as a rule a little lower than the left. They are usually considered to lie posterior to the peritoneum, but Arnold believes that they are placed between two layers of the peritoneum posterior to the general peritoneal cavity, so that the kidneys may be exposed without opening the latter.

The question may now be asked, How are the kidneys retained in their position?

The first anatomical structures which suggest themselves are the renal vessels and the ureter. These structures prevent the kidney from moving away from the middle line, but they permit it to pass upwards, downwards, and forwards, while its descent inwards and downwards is opposed by the meso-colon. According to Landau, this last mentioned attachment is more efficient upon the left than upon the right side. It must also be remembered that the kidneys are protected from pressure by the bony cavity of the thorax, by the spinal column, and by the large bones of the pelvis. But while these anatomical factors may be mentioned, there is one not yet alluded to of much greater importance—namely, the adipose capsule. The coverings of the kidney may be divided into two distinct portions, the true or fibrous capsule forming a thin, smooth, and firm investment, which can be easily separated from the substance of the organ, to which it is united by delicate processes of connective tissue, and by minute blood-vessels; and the outer capsule, tunica adiposa, composed of loose areolar tissue, in which a varying amount of fat may be deposited according to circumstances. In obese persons the fat is frequently considerable in amount, and may prove a source of error in estimating the size of the kidneys. The outer layer of the tunica adiposa is firmer than the part in apposition to the kidney. When corpulent persons emaciate rapidly, this capsule becomes very loose from absorption of adipose tissue, and its attachments to the kidney on the one hand, and to the surrounding parts on the other, become less firm than normal, and so may favour any tendency to undue mobility. During health this adipose capsule permits of a certain amount of movement; for instance, when the body comes to the ground with slight violence, the capsules yield to a limited extent, and immediately regain their former condition.

Before passing away from the anatomical relationship of the kidney to its surroundings, it may be well to direct attention to the following point — namely, that in many cases the posterior surface of the kidney lies against the crura of the diaphragm, so that in such cases more than a half of the kidney lies, during full expiration, above the level of the lowermost limits of the pleura, so that during a deep inspiration the organ must necessarily be depressed through the action of the diaphragm. The posterior surface of the kidney is also in close proximity to the quadratus lumborum muscle.

When the abdomen is opened in a living animal, or in operating for disease, the viscera are pushed forward through the wound. This is partly due to contraction of the abdominal muscles, and partly to the expansion of gas within the hollow viscera. But the fact that the expansion of gas takes place is a demonstration that the intestinal gases are subjected to greater pressure than that of the atmospheric air. This pressure must necessarily vary during the different periods of respiration, but putting aside the slight variations that must occur, we may describe this physical condition under the term of intra-abdominal pressure. By reason of this force the walls of the abdomen tend to retain the abdominal organs in position. If the abdomen be opened and the body raised upright, the liver and kidneys will fall perceptibly on account of their support being removed. The abdominal organs are very loosely bound to the parietes, and their limiting structures or capsules are easily distended, either by an alteration in the vascular condition of the organ, or by morbid processes. Should the support resulting from the elasticity and resistance of the abdominal walls be removed, or, what amounts to the same thing, should the contents of the abdomen be suddenly diminished in amount, as after delivery, then the suspension of the organs rests with their anatomical attachments.

Very little attention has hitherto been paid to the pathological anatomy of movable kidney, nor have pathologists been sufficiently careful to observe the various positions the kidney may occupy, or the amount of movement the attachments of the organs permit.

The following table of statistics of *post-mortem* records shows this:—

Observer.	Number of Autopsies.	Cases of Movable Kidney.
Durham (Guy's Hospital), ...	1,600	2
Schultze (Charitè Hosp., Berlin), 1859-1866,	3,658	5
Landau ,, ,, 1870-1879,	6,000	4
	11,258	11

These results, collected by the authors with much labour, are of no statistical value. Even in well marked cases movable kidney is apt to escape observation after death, especially when it is the habit of the pathologist to remove the kidneys before the intestine, unless his attention be specially directed to the point. Hence the search in reports of autopsies gives one result, the inspection of dead bodies by one interested in the subject a very different record. The statistics just quoted give 11 cases of movable kidney in 11,258 inspections. This is, as will be shown shortly, totally at variance with the statistics of clinical observers. For example, in 1,422 patients whom he examined, Skorczewsky found that 32 females out of 1,030, and 3 out of 392 males, suffered from movable kidney.

My own observations in the inspection room of the Glasgow Royal Infirmary, give a percentage of 1·8 cases in which the kidneys were movable through an area of more than three inches. Movement was most frequently observed on the right side, and usually was associated with emaciation of the body, a lax condition of the abdominal walls, and a looseness of the attachment and lengthening of the meso-colon on the right side, sometimes accompanied by lengthening of the renal vessels. In children the kidneys are, as a rule, freely movable when the abdomen is opened; when the body is placed erect the kidneys may fall some distance, but when again laid on its back the organs regain their normal position.

The changes which take place when a kidney becomes movable are limited to its surroundings; there is not necessarily any alteration in the structure of the organ, although in other instances there may be indications of organic disease. The changes in the surrounding structures may be divided into two kinds—those involving the adipose capsule, and those affecting the attachments. In the cases of slight mobility of the kidney, which I have observed in the *post-mortem* room, there has nearly always been atrophy of the adipose capsule, and frequently the kidney moved freely within it, but in all instances the fibrous capsule was found to be normal in appearance, and not loosened from its attachments to the kidney. The adipose capsule, when it becomes atrophied, permits slight mobility of the kidney, and as a natural sequence of these movements of the organ, the capsule becomes distended, and may ultimately form a considerable sac.

The distension of the adipose capsule leads to the peritoneum covering it being loosened from its position against the posterior abdominal wall. In the second variety the adipose capsule remains adherent to the kidney, and the movement is permitted from the peritoneum having become loosened, so as to form a pouch in which the kidney and its envelopes move more or less freely. We may therefore have three conditions—firstly, where the kidney moves in its adipose capsule, the capsule itself retaining its position. Secondly, where the first mentioned condition exists, and the capsule also has become movable. This is what was found in the case operated upon by me. The capsule formed a distinct sac freely movable behind the peritoneum, and the kidney was easily pushed backwards and forwards within it. Thirdly, those cases in which the capsule and kidney are adherent, but where the peritoneum, and the attachments of the capsule to the posterior abdominal wall, have become relaxed.

In a considerable number of instances of movable kidney, the renal arteries have been found lengthened, but normal in their origin from the aorta, unless when the condition has been congenital. Abnormal origin of the vessels seems to indicate a congenital condition, while simple lengthening of them does not prove the mobility to be other than an acquired state. Sometimes co-existing with the displacement of the kidney there are abnormalities of other abdominal organs, but this is more frequent in cases of floating kidney (to the pathology of which we shall refer hereafter) than in the condition at present under consideration.

We may now pass to consider the *causes of movable kidney*, and attempt to explain its mode of production. This may be done by studying the clinical history and physical signs, and by observing the pathological changes after death. Conclusions drawn from one of these methods alone must be unsatisfactory. On the one hand, by physical examination of the abdomen, it is not possible to ascertain, with absolute accuracy, whether or not the kidney is fixed, or movable to a slight degree; nor is it always easy to distinctly affirm that a freely movable body within the abdomen is or is not a kidney. On the other hand, there may be certain disturbances of function—for example, such as arise from torsion of the vessels, or of the ureter, or from pressure upon nerves, which are not accounted for by the appearances presented *post-mortem*.

We will therefore approach the subject both from the standpoint of the clinical observer, and from that of the morbid anatomist.

The first point to ascertain is, the relative frequency of the disease. Out of 5,500 patients examined in a German hospital for the special purpose of ascertaining this fact, 1 in 250 was found to have movable kidney. In 1,422 patients whom he examined, Skorszewsky found that 32 females out of 1,030, and 3 males out of 392, suffered from movable kidney. In 19 patients (2 males, and 17 females, 9 of whom were primiparæ, 8 multiparæ) the right kidney was movable; and in 11 patients (1 male, and 10 females, 6 of whom were primiparæ and 4 multiparæ) the left kidney was movable. Both kidneys were movable in 5 primiparæ. That is to say, over all the cases examined 2·5 per cent suffered from movable kidney; in women alone, 3·2 per cent, and in men alone, ·8 per cent. According to Oser, of Vienna, amongst the poor of Austria 10 per cent of the women who have borne children are affected.

CASES OF MOVABLE KIDNEY OBSERVED BY THE AUTHOR.

No.	Age.	Sex.	Pregnancies.	Complications.	Most Prominent Symptoms.	Probable Cause.
1	40	F.	7 in 15 years.	Menorrhagia ; ulceration of os and cervix. Both kidneys movable.	Gastric disturbance ; pain in kidneys and radiating ; suffering aggravated during menstruation ; emaciation.	Repeated pregnancies.
2	49	M.	—	Chronic bronchial catarrh and emphysema. Right kidney movable. Pendulous abdomen.	Rapid emaciation of stout individual ; abdomen pendulous ; gastric disturbance ; suppression of urine, due to strangulation of renal vessels.	Emaciation ; fall from horse.
3	43	F.	9 in 14 years.	Albuminuria ; tube casts in urine. Right kidney movable. Pendulous abdomen.	Gastric disturbance ; pain increased during menstruation ; suppression of urine, with increase in size of movable kidney, from torsion of ureter.	Emaciation and repeated pregnancies.
4	28	F.	—	None. Right kidney movable.	Gastric disturbance ; pain not increased by pressure ; no relation to menstruation ; no emaciation.	Fall.
5	24	F.	1	Spinal curvature. Right kidney movable.	Gastric disturbance ; pain in right kidney ; general emaciation.	?
6	30	F.	3	Anæmia ; great general weakness ; albuminuria. Right kidney movable.	Gastric disturbance ; jaundice lasting for a few days ; pain greatly increased during menstruation ; hysteria.	?
7	32	F.	7 in 11 years.	Prolapse of uterus and bladder ; pendulous abdomen. Both kidneys movable.	Severe pain ; only severe during menstrual periods ; suppression of urine from torsion of ureters by prolapsed bladder.	Repeated pregnancies and prolapse of organs.
8	27	F.	4	Phthisis pulmonalis ; great emaciation. Right kidney movable. Left kidney (?)	No symptoms pointing to kidneys.	Emaciation.
9	54	F.	—	None. Left kidney movable.	Severe pain in renal region ; temporary hæmaturia ; kidney became fixed after 5 months.	Fall.
10	37	F.	5 in 9 years.	None. Right kidney movable.	Movable body in abdomen, causing little discomfort except on pressure ; occasionally gastric disturbance.	Repeated pregnancies.

11	43	F.	10 in 14 years.	Prolapse of uterus; left crural hernia; pendulous abdomen. Right kidney movable.	Gastric disturbance; sensation of a foreign body in abdomen; pain slight, but increased during menstrual period.	Repeated pregnancies.
12	25	F.	—	None. Right kidney movable.	Severe gastric symptoms; intermittent hydronephrosis and suppression of urine; slight emaciation; pain in right lumbar region during menstruation, which was very irregular.	?
13	70	F.	10 in 16 years.	Carcinoma of uterus; albuminuria. Right kidney freely movable for ten years.	Great emaciation; severe pains in abdomen; symptoms very indefinite; movable kidney caused little disturbance till a year before death.	Repeated pregnancies.
14	28	F.	2 in 3½ years.	None. Left kidney movable.	No symptoms; movable kidney discovered accidentally when examining liver.	?
15	28	F.	5 in 6 years.	Emaciation; pendulous abdomen. Right kidney movable.	Menorrhagia; dyspepsia; occasional jaundice; severe pain in renal region; urine normal.	Frequent pregnancies.
16	46	F.	7	Emaciation; pendulous abdomen; retroflexed uterus. Right kidney movable.	Severe pain in renal region; gastric symptoms; emaciation; urine occasionally albuminous.	Emaciation.
17	54	F.	7 in 10 years.	Pendulous abdomen; hernia. Left kidney movable.	Gastric disturbance; little pain, but constant sense of foreign body in abdomen; hysteria; emaciation.	Frequent pregnancies.
18	40	F.	—	Phthisis pulmonalis; tubercular kidney (right); left kidney atrophied. Right kidney movable.	Pleurisy with effusion; great emaciation; severe gastric disturbance; albuminuria; persistent diarrhœa; symptoms of amyloid disease.	Emaciation.
19	38	F.	8 in 10 years.	Rapid emaciation; chronic bronchitis. Right kidney movable.	Severe cough; occasionally severe gastric disturbance with jaundice; renal pain increased during menstrual periods.	Cough and emaciation.
20	33	F.	—	Emaciation; anæmia; cough. Right kidney movable.	Gastric disturbance.	Emaciation.
21	?	M.	—	(Nervous prostration)? followed by emaciation. Right kidney movable.	Gastric symptoms.	?

The foregoing table contains an epitome of 21 cases which have come under my observation. An analysis of it with respect to the etiology will bring out the following facts. Of 21 cases 14 of the patients were emaciated considerably, and out of 19 females 10 will be found to have borne large families, and 6 to have suffered from pendulous abdomen. Then, as regards the principal symptoms, it will be found that 15 cases suffered from gastric disturbance, and in 7 the symptoms were aggravated during the menstrual periods. 6 patients had uterine complications, in the same number the renal pain might be described as severe, in 5 albuminuria was present, in 4 intermittent hydronephrosis was observed, in 3 jaundice, and in 2 hernia existed as a complication. The important facts revealed by these statistics, in respect to the causation of movable kidney, are, first, that the large majority of the cases are females, and that they have not only been the mothers of large families, but that the pregnancies followed one another in rapid succession; second, that many of the patients, previous to the kidney becoming movable, from some cause or another have rapidly emaciated; third, that the right kidney is more prone to displacement than the left; and, fourth, that displacement of the kidney is frequently associated with diseases of the female generative organs.

What, then, is the explanation of these facts? Let us consider the first mentioned—namely, the circumstance that females are most liable to this disease, especially those who have borne large families. The affection is much commoner than is usually supposed, nearly two and a half per cent of the patients examined having been found to suffer from it. The fact that mobility of the kidney is more common in women than in men is established by statistics. In 290 cases which I have been able to collect, 252 were in women, and 38 in men, or about one male case for seven female. The age at which this affection is most frequently met with corresponds to the child-bearing period, and a few years succeeding it. Thus, about 46 per cent of the cases were observed between the thirtieth and fortieth years, and 20 per cent from forty to fifty years of age, in all, 81 per cent between the ages of twenty and fifty.

The undue proportion of female cases and the period at which the malady is most commonly seen, seem to indicate that pregnancy has something to do with the production of the affection, either by causing an undue looseness of the abdominal walls, by pressure of the expanding or contracting uterus, or by the spasmodic voluntary muscular efforts during parturition. In the cases recorded by Sawyer, Becquet, Roberts, and others, most of the patients have been women who have borne children.

In the upper and middle classes of society, women, after delivery, usually retain the recumbent posture for some time—long enough to allow the abdominal walls to regain their firmness and elasticity. It is otherwise with the poorer classes; they require, from necessity, to resume their occupations as soon as possible, not unfrequently within a short time after delivery, without proper regard to their condition. Now, it is persons in this very class who are most subject to displacement of the kidney. The great majority of the patients whom I have seen suffering from these diseases were poor, and had been subjected to the conditions just mentioned. In many instances the pregnancies succeeded one another so rapidly, that the mother had no time to recover between these periods, and, consequently, progressive emaciation resulted. In such cases the peritoneum becomes stretched and flaccid, its union with the posterior abdominal wall loosened, and by the flaccid condition of the anterior abdominal muscles, pendulous belly ensued, the intra-abdominal pressure was thereby reduced, and so the kidneys practically came to be suspended by their anatomical attachments, which, as I have already shown you, were rendered unable to fulfil their function properly.

Dr. Sawyer, in a paper on the subject, remarks :—"Many, perhaps by far the larger number, of the subjects of floating kidney, are women who have borne children. All the examples which have fallen under my notice have been observed at some period after child-bearing. To what extent a difficult and protracted labour may be concerned as a cause, I am unable to say. The powerful and prolonged contractions of the diaphragm which are incidental to such a condition would, doubtless, favour displacement of the kidney. I think, however, the circumstances which determine the liability to this affection arise rather as a result of the sudden removal of pressure which the distended uterus exercises on the kidneys in common with other organs within the abdomen. The tendency to falling forward of the viscera, as a result of the impaired support afforded to them by the abdominal walls, in a woman who has borne children, seems likely to contribute to the production of floating kidney. Feeble women, with lax and atonic tissues, are probably more subject to this abnormality than those who are more robust."

Repeated pregnancies may be said to cause movable kidney in two ways: by inducing pendulous belly, and thereby diminished intra-abdominal pressure, and by causing emaciation of the abdominal adipose tissue, and consequently decreased bulk of the adipose capsule of the kidney. The tunica adiposa deprived of its fat, the areolar tissue becomes loose, and its attachments to the kidney on the one hand,

and to the surrounding parts on the other, become less firm than normal. When the emaciation is slow, a certain amount of accommodation may doubtless take place, but when it is rapid, movable kidney is very likely to result.

Emaciation may, however, lead to movable kidney independently of pregnancy. For some years I have paid special attention to the extent of movement to which the kidney is capable, in emaciated patients; in examining the cadaver, I have found that in the great majority of rapidly emaciating diseases, considerable movement of the organs is permitted. This was specially the case in such affections as acute phthisis, and in suppurative diseases generally.

As long ago as 1857, Oppolzer noticed that in patients suffering from movable kidney, and dying from other diseases, the kidneys, when examined, were found to be healthy, but in these cases "there has been observable a deficiency in the cushion of fat and a lengthening of the renal vessels," and Dr. Adams published in the same year a letter in which he said—"I remember many years ago having been requested by Dr. Langmore to examine the body of an old lady who was said then to have 'slipped her kidney.' . . . The only peculiarity remarkable was, that the kidney appeared bound down in its situation more loosely than usual, and the old lady, from having been very fat, had become somewhat thinner, and her integuments appeared very lax throughout. The condition of the kidney had nothing whatever to do with the cause of death." There is little doubt that an absorption of the fat surrounding the kidney will render the tunica adiposa more lax, and loosen the attachments of the organ, stretch the renal vessels, and permit undue freedom of movement and prominence of the kidney. When emaciation has been very rapid, I have seen the kidneys so loosely attached that they could be easily drawn out in front of the spine without employing force sufficient to injure the connections.

When considering this subject, it is well to refer to a possible fallacy arising from the circumstance that the adipose tissue around the kidney becomes firm after death, so that, even in a case where the kidney was movable during life, it might become so fixed after death as to escape observation.

It is a fact worthy of note that diminution of the fat around the kidney may take place without general emaciation. This I have noticed in several cases.

You will observe that in a considerable number of the cases given in the tables, the symptoms were aggravated at the period of menstruation, and in some of them, the increased pain was associated with augmentation in the size of the organ. Now, this increase in bulk is believed by some writers to be an important factor in the production of movable kidney. It has been asserted that the kidney becomes congested, increased in weight and volume, and that its attachments, are thereby stretched during this period; after menstruation the congestion subsides and the kidney regains its original size and weight. Doubtless, clinical observation shows, and anatomical research has proved the intimate relationship existing between menstruation and the vascular supply to the kidney, but while this fact cannot be denied, it would be rash to assert that there is any intimate etiological relationship between the two conditions.

Dr. Sawyer proposed this theory for explaining the production of movable kidney. In the cases which he has seen he has noticed the relationship existing between the menstrual period, and the time when movement of the kidney commences. Dr. Gueneau de Mussy adopts this view, but adds, however, that while he quite recognises that congestion may supervene, sometimes as a pathological condition, and sometimes as an epiphenomenon in the malady we are now considering, it must be admitted to be neither a constant cause nor a necessary complication, because movable kidneys are not uncommon in men. In several cases I have certainly seen an increase in the severity of the symptoms during the menstrual periods. In one, during the intervals, the left kidney seldom troubled the patient; but at her illnesses, which usually lasted for three or four days, it was sure to become displaced and give rise to severe symptoms. I fancied that the organ was increased in size and weight at these periods, and the patient, without the idea being suggested to her, several times remarked that she thought that her kidney was heavier when she was ill.

Becquet, Lancereaux, and Fourrier, as well as many others, admit the influence that menstruation has in the production of movable kidney, but Landau, though he admits the truth and value of Virchow's investigations, showing the close connection between the renal and uterine vascular supply, denies the direct relation of cause and effect between menstruation and movable kidney, because he thinks if the theory be true, "no woman who menstruates should fail to have a movable kidney." In saying so, Landau seems desirous of exalting his own theories by depreciating those of others.

The third point—namely, that the right kidney is more prone to displacement than the left, has still to be explained.

The following table is copied from Landau, and shows very well the comparative frequency of the condition on the right, left, and both sides :—

NAMES OF THE AUTHORS.	NUMBER OF CASES.	RIGHT KIDNEY.	LEFT KIDNEY.	BOTH KIDNEYS.
Aberle, ...	4	4	...	...
Rayer, ...	7	5	1	1
Dietl, ...	9	8	...	1
Rollet, ...	22	18	3	1
Henoch, ...	6	5	...	1
Guéneau de Mussy, . .	12	11	1	...
Jago, ...	5	5	...	...
Schultze, ...	3	3	...	...
Kowatsch, ...	5	5	...	...
Thun, ...	4	3	1	...
Klüpfer, ...	3	3	...	...
Fourrier, ...	6	5	...	1
Keppler, ...	11	10	1	...
Oerum-Howitz, . . .	34	28	4	2
Landau, ...	42	39	1	2
Total, ...	173	152	12	9

When the fact is known that the displacement occurs more frequently on one side of the body than on the other, one naturally seeks an explanation in the different anatomical relations of the organs on the two sides. The liver has been the organ most blamed. It is supposed that, either from its own weight, or by communicating the diaphragmatic movements, it presses down the right kidney. It is true that the liver seems more likely to cause displacement of the right kidney than the contents of the left hypochondrium to cause depression of the organ on that side ; and it is to be remembered that during deep inspiration the right kidney is pushed down more than the left.

Besides the presence of the liver, there are other anatomical peculiarities on the right side which deserve notice—the greater length of the renal vessels on that side, and the fact that the ascending colon is not so firmly bound to the right as the descending colon is to the left kidney, must have some effect in rendering the displacement more easy on the one side than on the other.

The various views which have been expressed in explanation of the fact now under discussion, may be summarised as follows:—(1.) Cruveilhier believes that displacement of the right kidney arises when pressure is exercised on the liver by the stays, so that the kidney is pressed between the corset and a solid organ, and thereby dislodged from the niche that it occupies. (2.) Lancereaux believes that there is a special sympathy between the right kidney and the right ovary on account of the more intimate connection between the ovarian and renal plexuses, by reason of which the right kidney, during the menstrual period, becomes more distended than the left, and hence its capsule is more apt to become stretched. (3.) Guéneau de Mussy holds that the uterus has a greater tendency to rise to the right side during pregnancy, and consequently exerts more pressure upon the right kidney. (4.) Landau argues that the different behaviour of the right and left kidneys seems to depend upon the difference in their mode of attachment. He writes as follows:—

"1. The *upper end of the descending colon* lies higher and is attached to the ribs further to the left and further down (seitlicher und tiefer) than the ascending colon. Whereas the ascending colon lies against the middle of the right kidney, the descending colon lies against the external convex border of the kidney. Hence it follows that the left kidney, although placed on the same horizontal level as the right, is fastened to the posterior abdominal wall both higher up and more firmly (höher hinauf und stärker) than the right.

"2. The *descending colon* and the *splenic flexure* are tauter (straffer) and shorter in their attachment to the posterior abdominal wall than the *ascending colon* and *hepatic flexure;* in other words, the mesocolon of the splenic flexure is shorter and tauter than that of the hepatic flexure. This indirect means of attachment is therefore stronger on the left than on the right.

"3. The *ascending colon* does not form a right angle with the *transverse colon* as the *descending colon* does, but an obtuse angle, or even forms a dependent loop before passing into the transverse colon.

"The reason for this peculiar behaviour of the ascending colon, which I have seen a few times in children, and many times in adults, and which *Sappey* has described as normal, appears to me to be the upward movement of the fæces in the ascending colon contrary to the action of gravity, and only effected by the peristaltic movements of the bowel. By this means the spot where the ascending becomes the tranverse colon is gradually dragged downwards so much as to form in extreme cases a fairly long loop, though it usually passes obliquely or with a curve into the transverse colon.

"But during the passage of the fæces from the transverse into the descending colon, the weight of the column of fæces and peristaltic action work in the same direction, no stagnation takes place in the splenic flexure, which maintains its original form. This difference between the hepatic and splenic flexures explains also in its turn how the right kidney has more room to descend than the left.

"4. The descent of the left kidney is opposed by *the* *position of its vessels* above the *inferior or horizontal part of the duodenum.* Moreover, the position of the aorta on the left side of the spinal column makes *the left renal artery* shorter than the right; this shorter attachment by means of the renal artery (which is naturally considered in this capacity before the thin-walled vein) renders the mobility of the left kidney the more restricted. Less stress must be laid on the circumstance pointed out by *Oerum-Howitz,* that the left suprarenal vein opens into the renal vein, while the right suprarenal vein opens directly into the vena cava, the left kidney (as opposed to the right) having thus an additional indirect connection with its suprarenal body.

"5. The left renal vessels are closely connected by cellular tissue with the head and neck of the pancreas, which thus furnishes an additional attachment to the left kidney, of which the right is destitute; for the right renal vessels lie bare, except for their peritoneal covering."

After careful consideration of the clinical facts as observed in the cases included in the statistics laid before you, and study of the views advanced by other observers, I have come to the conclusion that a satisfactory explanation has not yet been advanced to explain the fact now under discussion. The liver has no doubt been blamed for causing displacement on the right side, either from its own weight, or by communicating the diaphragmatic movements. Although I believe the liver is largely to blame, the explanation of Cruveilhier, that displacement arises from the pressure of stays communicated through the liver to the right kidney, seems to me quite untenable. I would rather say that as far as the pressure of stays is concerned, the right kidney is actually protected by the liver.

It must be remembered that the right kidney does not lie below the liver when the body is in the erect posture, but really behind it, the posterior margin of the liver overlapping the kidney fully an inch and a half. The anatomical condition of matters is therefore as follows:—The posterior surface of the right kidney is practically in contact with the crura of the diaphragm and the great lumbar muscles, while interposed between its anterior surface and the anterior abdominal wall there is a large solid organ—the liver. Now, suppose that the patient strains the abdominal muscles, as during delivery, or in lifting a heavy weight, both the anterior and posterior abdominal muscles are brought into powerful action, the liver being pressed backwards by the anterior muscles, the kidney pressed downwards by the crura of the diaphragm, and forwards by the posterior abdominal muscles. Now, the resultant of these forces will act in a manner similar to what takes place when one presses a bean between the finger and thumb—that is to say, the kidney will be pressed downwards. This seems to me a more reasonable explanation than any of the others which have been advanced. I would not, however, for a moment assert that other considerations are not to be entertained, such as the greater length of the renal vessels on the right side, and the fact that the ascending colon is not so firmly bound down to the right as the descending colon is to the left kidney. These and other slight anatomical differences have been made much of by Landau, who seeks to explain the different behaviour, of the right and left kidney as regards mobility, entirely by the differences in their mode of attachment. The interposition of a solid organ between the anterior and posterior abdominal muscles in the right hypochondrium, and the want of it in the left, fully explains, to my mind, the relative frequency of right and left movable kidney. At present I have under observation a gentleman of our own profession, who has for some years suffered from movable kidney. He is able voluntarily, when the kidney is in its normal position, to press it downwards by an exertion of the abdominal muscles.

There is still a series of complications deserving of attention—namely, the relationships of numerous displacements of the generative organs to movable kidney. In 6 out of 19 cases the female generative organs were displaced or diseased, showing that there must be some relationship in the etiology of the two conditions, probably some disturbance of the intra-abdominal pressure. Displacement of the uterus may act in two ways upon the kidney; it may, if prolapsed, drag upon the fundus of the bladder, and, through the ureters, upon the kidney; or, by causing torsion of the lower end of the ureters, it may impede the passage of urine, and cause an accumulation within the pelvis of the kidney. This increase in weight, with alternate distensions and relaxation of the renal attachments, leads to displacement. In three cases the direct cause of movable kidney was a fall, in one (case No. 9) associated with hæmorrhage around the kidney. We have thus briefly glanced over the principal causes of the disease we are now discussing, and I have attempted to explain to you their rationale.

We now come to what will be to you a more interesting part of our subject—the *symptomatology*. In the great majority of cases, the patient accidentally discovers the tumour without attention having been directed to it by painful or other sensations. When, however, it has become known that one of the kidneys is movable, it is common to find symptoms develop which are referred to the condition of the kidney.

When the movement of the kidney is slight, there may be no subjective symptoms, and it may only be after death that the condition is revealed. The subjective symptoms may be entirely absent, or so slight as not to attract the attention either of the patient or the medical attendant, and they may be chiefly of a local character. In the majority of cases, however, the patient becomes conscious, often accidentally, of the presence of a movable tumour in the abdomen, and complains of a feeling of weight and uneasiness in one or both loins. The pain usually experienced is of a dull character, but may occur in severe paroxysms resembling nephritic colic, and when the kidney is manipulated or pressed upon, a sinking, sickening sensation is experienced. This sinking sensation, or "fainting pain," as the patient calls it, is very characteristic.

In 15 out of 21 cases, symptoms which might be classed under the term gastric disturbance, were found to exist. In many instances, the patient simply suffered from loss of appetite, epigastric pain, and nausea, and these discomforts might only be present while the kidney was displaced. But while in some cases the disturbance was slight, in others it was more severe, amounting sometimes to chronic dyspepsia, vomiting, diarrhœa, jaundice, and other symptoms of chronic or acute gastric catarrh. Sometimes the symptoms are fully explained by the condition of the kidney, while in others it will be more reasonable to assume that the gastric disturbance, and consequent emaciation was the cause, rather than the effect. When, however, in cases associated with severe gastric symptoms, the discomfort of the patient is relieved by maintaining the kidney in its normal position, it is demonstrated that the movements of the kidney within the abdomen are either directly or indirectly to blame.

These symptoms are not caused simply by direct pressure, for we know that large tumours may exist, and move freely within the abdominal cavity without causing much reflex disturbance; it is more probable that they are due to dragging upon the renal vessels and nerves. When you call to mind the rich network of sympathetic ganglia and nerves which surround the kidneys and suprarenal capsules, you can easily appreciate how movable displacement of the organ will lead to painful sensations extending in many directions. Hence, in movable kidney, the pain may extend to the loins, abdomen, chest, thighs, along the ureters, or it may lead, as I have just mentioned, to disturbance of function as indicated by symptoms of gastro-intestinal catarrh.

In three cases slight and occasional jaundice was noticed, seldom sufficient to cause much colouration of the skin, but recognisable by the change in the appearance of the conjunctiva, and the presence of bile in the urine. The appearance of this symptom was usually accompanied by an increase in the severity of the others. In respect to the presence of jaundice as an accompaniment of movable kidney, various explanations have been offered. Litten cites a case of Frerich's in which the jaundice recurred twice within two weeks, but only lasted for a few days, and he assumes that the symptom was due to temporary compression of the common bile duct. This theory cannot explain the jaundice in my cases. I am more disposed to think that the obstruction to the flow of bile was caused either by catarrh of the gall duct, or by gall-stone.

In six cases, the patient suffered from more or less severe pain. The pain is usually of a dull character, dragging, constantly present while the erect posture is maintained, but relieved when the patient lies down. Occasionally there may be the sense of something moving, as marked as the movements of the fœtus *in utero.* The pain is usually limited to the affected side, but may extend down the legs as far as the knee, to the chest, loins, or over the abdomen. On pressure, a peculiar sinking sensation is experienced—as one of my patients expressed it, "much the same as when the testicle is pressed or bruised."

Besides these constant pains, severe paroxysms may occur resembling nephritic colic. These attacks are apt to follow upon exertion of any kind, but especially much walking, long standing or sitting, and, in females, they frequently occur during menstruation.

The next class of symptoms which demand our attention are those arising in connection with the urinary system. They depend on torsion producing one of two conditions—namely (1) constriction of the ureter, or (2) occlusion of the blood-vessels. In four cases there was evidence of the former condition existing, as manifested by transitory hydronephrosis. The connection between movable kidney and the periodical emptying and filling of the sac of the hydronephrosis, shown by the appearance and disappearance of the tumour, as well as sudden suppression of urine followed by a copious flow, is well illustrated by the following cases (III and VII):—

Case III.—Mrs. M'D., æt. 43, enjoyed good health till after the birth of her last child (9th). Her last delivery was followed by symptoms which, at the time, were not very well understood, owing to their vague character. Within fourteen years she had nine children, all still alive, and two miscarriages, the first at the fifth month, between the birth of the third and fourth children, and the second at the fourth month, between the birth of the eighth and ninth children. After the last delivery, she experienced sensations of vague uneasiness, not amounting to actual pain, but sufficient to prevent her from engaging actively in her household work. She became thin and anæmic, and menstruation, although regular, was profuse, and accompanied by an unusual amount of discomfort. About six months after the birth of her last child she complained of a pain, and at the same time, became conscious of the presence of a movable tumour in her right side. Handling the tumour did not increase the pain very much, but caused her to become sick, and sometimes even to vomit. A few months later the pain became more severe, and dyspeptic symptoms manifested themselves. These symptoms were most marked during the menstrual periods, after taking exercise, and when the bowels were constipated.

When I saw her for the first time, in December, 1881, nine months after her last delivery, the symptoms had become aggravated, so that she required to remain in bed while she was menstruating. On examination of the tumour on the right side, its nature became apparent. It was easily made out to be a movable kidney, as it presented all the characteristic physical signs which I need not here mention in detail. I examined the urine carefully, and found it to be strictly normal.

The following note was made on the 14th December, 1882:—The symptoms are now very marked. Patient complains of almost continual pain, usually localised in the right lumbar region, but sometimes extending all over the abdomen. It is greatly aggravated during menstruation, but becomes very severe at other times quite independently of ovulation. At these periods other symptoms are present, which seem to indicate obstruction to the excretion of urine. They generally appear very suddenly, and usually follow some sudden exertion at a time when the kidney is misplaced. They may last only for a few hours and disappear almost as suddenly as they arose, or they may endure for a period of twenty-four or even thirty-six hours. The first indication of one of these attacks is a sudden diminution in the quantity of urine excreted, sometimes amounting to almost total suppression. The suppression of urine is followed by a rapid increase in the size of the movable tumour in the abdomen, which on these occasions occupies a position a little to the right of the middle line, with its lower border about an inch above the inner third of Poupart's ligament. The symptoms here referred to are different from those that are present during the menstrual periods; they consist of severe pain in the renal region, coming on in paroxysms and lasting for some time, accompanied by sickness, nausea, and vomiting. Their severity varies considerably in different attacks; sometimes they are relieved by rest in bed for a day, at other times they last longer, and are followed by symptoms of uræmia, such as dimness of sight, severe and persistent headache, and lethargy, with or without occasional paroxysms of excitement.

During the time these symptoms are present the quantity of urine is greatly diminished. The first indication of recovery is a sudden flow of concentrated urine, and a diminution in the size of the renal tumour, followed by the secretion of a large quantity of urine of a low specific gravity.

The following is a short note of the examination of the urine before, during, and after one of these attacks:—

1882.		Quantity.	COMPOSITION IN 1,000 PARTS.					
			Urea.	Uric Acid.	Phosph. Acid.	Chlorides.	Other Solids.	Total.
Dec. 9, .	10 A.M.	10 oz.	19·3	·41	1·95	10·1	5·2	36·96
,, 9, .	7 P.M.	8 oz.	36·3	·54	2·61	12·	6·3	57·75
,, 9, .	7·40 P.M.	18½ oz.	11·1	·19	·73	4·	2·1	18·12
,, 9, .	10 P.M.	16 oz.	12·3	·2	·61	5·3	3·	21·41
,, 10, .	1 A.M.	9 oz.	16·1	·5	1·3	11·	3·	31·9
,, 10, .	7 A.M.	7 oz.	23·4	·5	2·5	10·2	3·4	40·0

It will be observed that the specimen collected at 10 A.M. was practically normal. About noon the attack commenced, and continued till about 7·30 P.M. At seven o'clock, eight ounces of concentrated urine were passed, containing very nearly six per cent of solids, and at twenty minutes to eight, eighteen and a half ounces of dilute urine, containing less than two per cent of solids, were collected. In none of the samples examined could any abnormal constituent be detected, and, on microscopic examination, nothing was observed worthy of note. The explanation of the condition of the urine is rather difficult. If we suppose that the suppression of urine is due to torsion of the renal vessels, or of the ureters, then it would be expected that this condition would be limited in its effects to the movable kidney, and that the opposite kidney would perform double duty, and so prevent symptoms of defective elimination of urine. The increase in the size of the movable tumour at the time the symptoms are present, and its disappearance before they are relieved, indicate very clearly that the attacks are due to obstruction to the flow of urine through the ureter, rather than to a suppression of the secretion as a result of strangulation of the renal vessels. The flow of a quantity of concentrated urine just before the symptoms disappear, and the simultaneous reduction in the size of the tumour, are easily associated as results of a common cause—the relief of the obstruction. The concentration of the urine seems to be due to absorption of a portion of the water contained in it during its lodgment in the distended ureter and pelvis.

It seems very extraordinary that what appear to be symptoms of uræmia, should occur so suddenly and be removed immediately after the obstruction to the ureter has been relieved. That a patient can live for eleven days without any kidney tissue, the only kidney she had having been removed, has been demonstrated by a case of Dr. Polk's, of New York, and the fact that during a considerable portion of that time, no symptoms of uræmic poisoning manifested themselves, renders it all the more remarkable that, in my case, immediately after the suppression of urine, symptoms closely resembling uræmia should appear.

The attacks which accompany menstruation differ from those occurring along with suppression of urine. The pain is not so sharp, does not occur in paroxysms, is of a dull dragging character, and is not accompanied by other than slight dyspeptic symptoms, or symptoms referrible to the condition of the uterus.

17th February, 1883.—Since last report patient has had two attacks associated with suppression of urine. The first was a mild one, the second, which happened on the 15th inst., was very severe and continued for three days.

A physical examination of the abdomen, made to-day, shows the kidney to be rather smaller in size than it was when I first examined it (December, 1881), and the movements are somewhat increased; when grasped with the hand, the sensations experienced by the patient are more disagreeable than they were formerly. The most important fact to be noted is the appearance of small quantities of albumen in the urine, which is now more copious than it was a month ago; its sp. gr. is low (1008–1012), and it occasionally contains a few hyaline and granular tube casts.

The anæmia is more marked than it was formerly, the features are pinched, the derangements of the digestive organs, loss of appetite, nausea, and irregularities of the bowels are more complained of than they were a few months ago.

Instead of giving the detailed account of the case as I have it recorded, I will give a general summary of the facts as noted from the beginning of this year till the present time.

Urine.—Since the beginning of the year the urine has been copious, of a low specific gravity, and containing a variable quantity of albumen. There was considerable difficulty in ascertaining regularly the exact quantities passed in the twenty-four hours, but as far as can be learned, they were considerably above the normal. On several occasions the whole of the urine was kept and carefully measured, when it was found to amount to from 70 to 90 oz. On no occasion, except after the attacks described above, has the specific gravity exceeded 1014. The average for the last five months is 1011, and the minimum 1007. The albumen varies in quantity from time to time, and is even sometimes temporarily absent. It has never been found to exceed ·210 per cent, and as a rule does not amount to more than ·08 per cent. The deposit in the urine is slight, composed of finely granular epithelium, mucus, leucocytes, and it occasionally contains hyaline or granular tube casts.

The Movable Kidney.—The kidney has shown a general tendency to diminish in size, so that at the middle of

June, 1883, it appeared to be about a third less than it was in January, 1882. It continues freely movable, and when displaced, does not recede so easily into its normal position as it did at one time. During the first five months of this year patient had four attacks of severe pain, accompanied by suppression of urine, besides the inconvenience she has experienced during the periods of menstruation, and the sense of general discomfort from which she suffers at all times. About a month ago she was very anxious that I should operate upon her, as she was convinced, if the kidney was fixed, that she would enjoy her usual good health. The treatment, both during the attacks and in the intervals, procured her a certain amount of relief, but with this she was not contented, and desired something to be done that would cure her of her complaint.

The presence of albumen and tube casts in the urine was a very serious complication. The fact, however, that the right kidney was contracting, gave rise to some hope that it alone was diseased, and that the left kidney was still healthy, and in a condition to take up double duty if required.

Before entertaining the question of an operation, it was necessary to establish beyond doubt that the left kidney was healthy, and with this object in view, I considered the various ways by which it might be done. There was not much difficulty in being tolerably sure that there was a left kidney, as evidence of its presence in its normal situation was clear. The point to settle was whether or not it was normal. The only method of determining this seemed to be to procure by some means separate samples of urine from each ureter. I therefore catheterised the ureters by the method which I will explain hereafter. The following note on the condition of the urine shows that an operation, such as excision of the right kidney, was out of the question, and that even nephrorraphy would be attended with great danger to the life of the patient:—

Urine from right kidney three hours after it was drawn off:—Pale straw colour, slight deposit, neutral reaction, sp. gr., 1012, urea, 1·10 %, albumen, ·35 %; no blood, bile pigments, or sugar. Microscopic examination showed the deposit to be composed of mucus, a few leucocytes, granular and fatty epithelium, but no tube casts could be detected.

Urine from left kidney:—Pale straw colour, slight deposit, neutral reaction, sp. gr., 1010, urea, ·95 %, albumen, ·38 %; no blood, bile pigments, or sugar. Microscopic examination revealed, in addition to the deposits found in the other sample, the presence of fatty, finely granular, and one or two epithelial tube casts.

In this case it is very evident that the constriction of the ureter, and the consequent temporary hydronephrosis were due to rotation of the kidney on its short axis. By this rotation the ureter became wound round the vessels, and consequently the flow of urine from the pelvis to the bladder was impeded, so long as the kidney occupied that position.

Again, transitory hydronephrosis may result, not from the cause just mentioned, but as a consequence of displacement of the bladder. Suppose that the fundus of the bladder becomes dragged down by a prolapsed or displaced uterus, then the ureters become bent at a more or less acute angle, and as a result, not only the pelvis, but also the ureters throughout almost their entire course, are distended by the retained secretion. Transitory hydronephrosis was produced in this manner in Case VII. The patient was aged 32, and had borne seven children in eleven years. When I saw her she was suffering from pendulous abdomen, prolapse of the uterus and bladder, and both kidneys were movable.

It is unnecessary to enter further into the details of the case than to say that she only suffered severe pains at the periods of menstruation, and when the uterus was prolapsed. On the latter occasions she complained first of slight, and afterwards of severe pain in the renal regions, succeeded, as a rule, by vomiting, by a sudden diminution in the quantity of urine excreted, and an increase in the size of the movable kidney. When the uterus and bladder were replaced, then after a longer or shorter interval the patient experienced a sensation, as she said, "of something dropping into the bladder," and immediately thereafter she evacuated a quantity of practically normal urine. Transitory hydronephrosis, associated with movable kidney, has now frequently been observed by operation, by Landau, Czerny, Wagner, Ahlfeld, and Pernice, so that the explanation of their etiological relationship is not a theoretical speculation, but a demonstrated fact.

We now come to the consideration of other symptoms arising in connection with the urinary system—namely, those caused by torsion leading to occlusion of the blood-vessels. This condition is well illustrated in the following:—

CASE II.—W. O., æt. 49. For the last three years patient, who was at one time very stout, has been emaciating. He has suffered a good deal from chronic bronchial catarrh, attended with considerable muco-purulent expectoration, which, on microscopic examination, is found occasionally to contain a few blood corpuscles, and a considerable quantity of pus. The physical signs are indicative of chronic bronchitis, accompanied by slight emphysema, without bronchiectasis.

The history of the case, as far as the movement of the kidney is concerned, dates from the beginning of the year

1882. He was out riding one day, when his horse stumbled, and he fell on his left side and fractured two of his ribs (the 9th and 10th left). He was kept in bed for about a fortnight after the accident. During this time he complained of a pain on the right side, immediately below the edge of the liver. The practitioner attending him at that time suspected an abscess, and treated him accordingly. While he remained in bed he did not notice any swelling or tumour on the right side, but after he got up he discovered a movable tumour seated in the hypochondriac region.

When I saw this patient for the first time, he complained of pain in the right renal region, attended with vomiting, and sometimes followed by diarrhœa. The pain usually came on suddenly, and lasted for five or six hours. He noticed that if he took much exercise, or if the bowels were constipated, he was more apt to have an attack; when he took to bed the symptoms soon disappeared, but, on the other hand, if he continued to take even moderate exercise, the pain caused him considerable inconvenience.

On examination I found him greatly emaciated—the belly was loose and pendulous; palpation of the abdomen revealed the presence of an oval tumour immediately under the lower edge of the liver, and about two inches from the umbilicus. The tumour could be freely moved about in the abdomen, and pushed down into the pelvis, upwards under the edge of the liver, and an inch to the left of the middle line. Percussion over the right renal region, or over the tumour, did not yield any satisfactory results; but when the right loin was examined, the kidney having been previously displaced, a distinct flattening could be made out. When the tumour was handled a sickening sen-

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sation was experienced, resembling, as the patient informed me, the pain produced when the testicle is squeezed. A careful examination was made with the object of detecting the pulsation of the renal artery, as this case appeared to be a very favourable one for this purpose on account of the thinness and looseness of the abdominal wall, but no trace of movements resembling pulsation could be made out.

The only other symptom worthy of notice was the occasional sudden suppression of urine, without any very evident cause, and without any apparent relation to the position of the right kidney. Sometimes it commenced without the organ being displaced, at least so far as could be detected by the hand, and there was no increase in the size of the organ during the time this symptom was present. The only explanation I can give for the scanty secretion of urine, is to suppose that the kidney was rotated on its short axis, so that the ureter and blood-vessels were coiled round one another, and the passage of blood to and from the kidney was thereby prevented. The urine passed when the secretion again became active did not differ from what was voided at other times. The following table will show the quantities and specific gravities of seven samples collected during one of the attacks. There was no urine passed between 11 A.M. on the 28th and 1 A.M. on the 29th of November:—

		Quantity.	Sp. Gr.	Urea.	REMARKS.
1882. Nov. 28,	7 A.M.,	10 oz.	1015	1·75 p. c.	Slight deposit of urates.
,,	11 A.M.,	8 oz.	1017	1·85 ,,	,, ,,
Nov. 29,	1 A.M.,	3 oz.	1016	1·7 ,,	Considerable deposit of urates.
,,	3 A.M.,	10 oz.	1019	1·9 ,,	,, ,, ,,
,,	8 A.M.,	6 oz.	1014	1·5 ,,	No deposit.
,,	1 P.M.,	7½ oz.	1014	1·55 ,,	,,
,,	5 P.M.,	10 oz.	1018	1·7 ,,	,,

The symptoms arising from torsion of the vessels, and of the ureter are somewhat similar; in both you have a sudden diminution in the quantity of urine, accompanied by pain in the renal region, vomiting, persistent headache, and even symptoms of uræmia, but in torsion of the vessels there is no increase in the size of the kidney by retained secretion. The flow of urine, which succeeds replacement of the kidney in its normal position, is copious, but it is of high specific gravity instead of low, as from a transitory hydronephrosis.

The *physical signs* observed in movable kidney vary slightly in individual cases. If the patient be much emaciated, and the kidney freely movable, a tumour of characteristic renal form may be felt, and sometimes its outline may be even seen resting against the anterior abdominal wall, when the patient assumes the elbow-knee position, and at the same time a flattening or depression in the corresponding lumbar region may be observed.

The sensation communicated to the fingers by the kidney can scarcely be mistaken for that of any other kind of tumour, and it is said by some observers that pulsation of the renal artery may be felt; of the truth of this latter statement I have some doubt. The kidney forms an oblong, hard, and resisting mass, the lower extremity rounded, the surface very smooth; it is easily pushed in various directions, downwards, upwards, and laterally, and glides with great facility into the lumbar region. In most cases the abdomen is so flaccid that the organ can be easily grasped with the hand, and when it is manipulated a sickening and peculiar faint sensation, frequently accompanied by pain shooting down the thigh and lower part of the abdomen, is produced. When the hand is applied to the postero-lumbar region a depression may be felt when the kidney is displaced, but when it is thrust back to its normal position the natural sense of resistance in the renal region is restored.

It is advisable to place the patient on the right side while examining the left kidney. Press the left hand on the lumbar region, and push the kidney forwards and downwards against the right hand, which supports the abdominal wall in front. This bimanual palpation is the most satisfactory method of manipulating the abdomen.

On percussion over the renal region posteriorly a tympanitic note may be elicited; but a dull note is not got, as might be expected, over the displaced kidney, but rather a muffled tympanitic one. This, of course, is due to the fact that anteriorly the kidney is usually, I might say always, covered by a layer of intestine.

The note heard on percussion over the renal region in cases of movable kidney shows how unreliable percussion is as a means of diagnosis as to the position of the organ, unless it is considerably enlarged. In some cases displacement of the kidneys makes very little difference in the percussion note; by this means alone it would be impossible to tell when the kidney was in an abnormal position and when it was in its proper place. The sense of resistance on percussion, and the feeling communicated to the hand when it is applied to the region, give more trustworthy results.

The value of the percussion note heard over the lumbar region, depends upon the amount of emaciation, and whether the displacement is on the right or left side; and when it is remembered, as long ago pointed out by Skoda, that the bulk of normal kidney has little to do with the diminished resonance in the lumbar region, one is prepared to admit that, in the majority of cases, percussion fails to give reliable information.

The respiratory movements may influence the position of the kidney, deep inspiration may press it down, and forced expiration cause it to ascend; while the posture of the body tends greatly to alter its situation. When the patient sits up the kidney falls towards the pelvis, when she lies on her side the kidney inclines towards the middle line or away from it, as the case may be, and if she assumes the supine posture, the organ passes back to its proper place.

The movements of the kidney, as influenced by respiration, are well exemplified by reference to the following extract from a letter I received from Dr. ——— (Case 21). My patient writes:—

"I think you wanted me to state the degree of mobility of my kidney during respiration. I can demonstrate this to myself very readily—much better, indeed, than another man can feel it, since I have a double guide—the sensation in my fingers and the sensation in my kidney.

"I. *In the erect position,* (1) with the *kidney down,* its lower border can be felt on a level with the anterior superior spine of the ileum. Tranquil respiration causes a scarcely perceptible vertical movement, just recognisable by the fingers placed lightly over the lower edge of the kidney; while forced respiration, in this position, produces a movement of nearly an inch. (2) *With the kidney up* in its normal position, and kept there by the tips of the fingers of both hands, pressed deeply into the lumbar region along the lower border of the liver, the kidney is felt moving *very distinctly* during ordinary respiration, and the fingers have to be kept well pressed backwards to retain it *in situ.* Even then it tends to escape *outwards* (*i.e.,* to the right) with each inspiration. On forced inspiration, again, it descends with such energy that the fingers are pushed forwards until a certain point is reached, when it slips suddenly from under them, and gets into its abnormal unsupported position. This descent is accompanied by a tendency to the right, and (*I think*) by a certain amount of rotation, bringing its convex border downwards towards a horizontal position."

"(II.) *In the recumbent* (*supine*) *position*, it falls spontaneously under the ribs, and takes up nearly its normal site. In this position the respiratory movements have much less effect on it, but forced inspiration still causes a distinctly perceptible descent. When the fingers are deeply pressed in under the lower costal border, so as to replace it fully, the movement on inspiration is much more decided.

"The extreme vertical range of the kidney movement, (in any position) between complete expiration and full inspiration, is about 1½ inches."

While some patients have the power, by a muscular effort, to throw the kidney out of its place, in others, when the organ has been restored to its normal position, it is sometimes difficult to displace it again. This circumstance is sometimes of diagnostic value. In a few exceptional cases the kidney may occupy the iliac fossa, and considerable displacement may exist without any foreign body being felt through the abdominal parietes.

The *diagnosis* of movable kidney, when uncomplicated by the presence of other abdominal tumours, is comparatively easy, the errors chiefly arising from practitioners not thinking of the occasional occurrence of the disease. Movable kidney is one of those conditions which one is very apt to overlook, simply because it is rarely met with in practice, and although generally recognised as a possible accident, yet the contingency is not taken into consideration in diagnosing the case. Thus, cases are upon record where a movable kidney was mistaken for a spleen, an enlargement of the liver, an abscess, a malignant tumour, and a tumour of the ovary.

In stout individuals, a class of persons in whom movable kidney is not at all frequent, the condition may be difficult to detect by physical examination, but in the great majority of cases the presence of a movable tumour can be easily made out. We have already described the physical signs, so that it is unnecessary again to refer to them further than to say that it is almost entirely upon a proper apprehension of them that the diagnosis of the case rests.

The diseased conditions with which movable kidney is most apt to be confounded are enlargement of the gall bladder, small ovarian tumours, tumours of the mesentery, tumours of the omentum, tumours of the spleen, tumours of the ascending and descending colon, tumours of the kidney, and fæcal masses in the colon.

An enlarged gall bladder may sometimes be mistaken for a movable kidney. Mr. Lawson Tait mentions a case upon which he operated, where the diagnosis of movable kidney was made, but which proved ultimately to be one of enlarged gall bladder, containing about a pint of thick, glairy mucus, and eighty gall stones of small size. The tumour was freely movable, it seemed solid, and was shaped like a kidney. It was tender on pressure, and when the hips were raised above the level of the shoulders it could be made to disappear. There was no jaundice.

The points in the physical diagnosis, which would distinguish an enlarged gall bladder from a movable kidney, are these—the position which it occupies, the fact of the lower part of the tumour being more freely movable than the upper, of the lower end being more rounded, and less resistant on pressure, and the presence of an occasional sense of fluctuation; if in addition to these there be evidences of obstruction to the gall ducts, such as jaundice, absence of bile in the stools, &c., then the probability is in favour of the former condition.

Should the symptoms not be sufficiently characteristic, then by tapping the gall bladder, the diagnosis may be completed.

Small ovarian tumours, such as fibro-myomata, located either on the surface, or in the substance of the ovary, might lead to some difficulty in diagnosis. The size and form of the mobile body, the possibility of tracing the tumour to its attachment, and the tendency to increase in size or remain stationary, will help to clear up the case. When the ovarian tumour is large, a mistake in diagnosis is not likely to be made. When small, it may be freely movable, and a certain diagnosis may be extremely difficult. The signs of most value are the superficial situation of the growth, its tendency to increase in bulk, and dull percussion anteriorly, while the fact that the symptoms are not marked, leads one to presume that the growth is of ovarian origin.

Tumours of the mesentery and omentum are very difficult to distinguish from movable kidney. They are, however, dull on percussion, they seldom move into the lumbar regions, and certainly do not slip into that region in the way that a movable kidney does. Their movements are usually limited to the middle third of the abdomen, they are generally rounded in form, and the vessels passing to them do not give rise to pulsation; nothing corresponding to the hilus can be detected, there is not the usual sinking pain on pressure, nor is there absence of the kidney from its normal position.

Movable spleen may be distinguished from a kidney by the fact that it lies immediately beneath the abdominal wall, and over it the percussion is generally dull. This I have observed in the only case of movable spleen which has come under my notice, but I think I am correct in stating that the general consensus of opinion is that movable spleen rarely co-exists with a tympanitic note.

Tumours of, or fæcal masses retained in, the ascending and descending colon, may give rise to physical signs somewhat resembling movable kidney; but a study of the history of the case, and the use of purgatives, is generally enough to clear any doubts there may be as to diagnosis.

When the nature of the case has been distinctly made out by a careful physical examination, the indications for treatment are sufficiently clear. If, however, the disease is not properly understood, as seems frequently to be the case, not so much from the difficulty in diagnosis as from the possibility of such a malposition not having been brought under the attention of the medical attendant, the patient may be subjected to utterly useless, troublesome, and sometimes injuriously active treatment.

In some persons the inconvenience experienced from displacement of the kidney is not considerable, and very little treatment is required; indeed, in many instances, the symptoms produced are so slight that the condition has been discovered by the patient quite accidentally, and independently of them. In others, disagreeable impressions may only be felt while the patient is moving about or engaged in active employments; when in bed there may be immunity from pain and other symptoms. There are cases, however, where the functions of the neighbouring organs are greatly interfered with, and severe pain is produced by the displacement of the kidney, so that the patient is unable to perform ordinary household duties, or life may even be endangered.

We now come to the consideration of *treatment.*

So far as the physical condition is concerned, the evident indication is to endeavour to replace the organ in its normal position and keep it there. With the patient in the recumbent posture, the kidney should be replaced by manipulation and gentle pressure. This is usually very easily accomplished; the difficulty is to keep it in position without exerting undue pressure on it, or upon the neighbouring parts. Various methods have been proposed—tight bandages or belts round the abdomen, with a pad over the kidney to give the pressure more pointed effect; elastic bandages applied in a similar way, and trusses, have all been employed for the purpose of fixing the kidney by external support.

The tight bandage (calico or woollen) seems to me to be of very little service; it very soon becomes loose, and falls out of position.

Dr. Smith, of New York, has devised a truss for retaining the organ in position. It resembles a hernia truss, except that the spring is straight instead of oblique, and is made long enough for the posterior pads to rest on the side of the spinal column, opposite to that on which the displacement exists. On the posterior end of the truss there are four small pads so placed that two rest on each side of the spinal column, and on the anterior end a soft rubber air pad is fixed, which may be blown up by a tube attached to it, and made either tense or flat, as may be required.

Whether a bandage or a truss be employed, it is necessary that it should be applied in such a manner that the patient can keep it on continuously without discomfort, otherwise it is of little or no use. Even although the symptoms disappear for the time being, if the patient suffers from pressure of the appliance, she will soon throw it off.

The method of employing pressure which I have found most useful and most easily applied by the patient, is to have a well fitting abdominal elastic bandage, extending from the line of Poupart's ligament to the level of the sixth or seventh rib. The bandage should be made to fit the body accurately and firmly, but without exerting undue pressure at any point. It may be made of one piece, or, what I consider much better, of strips of elastic bandage sewn together, and united in the middle line in front by means of steel slips, similar to those used for fixing corsets. The patient should have her bowels well opened every morning, and then, before getting up for the day, should slip over the lower extremities, and upwards around the abdomen, a tight-fitting jersey, applying over the region of the kidney an air pad, and then buckling over it the broad elastic bandage.

The air pad is so made that it may collapse while the patient is putting on the bandage; after the bandage has been adjusted, the pad is inflated by means of a tube carried to the mouth, and provided with a stop-cock. These pads have been made by Messrs. Hilliard & Son, Renfield Street, Glasgow. It is a matter of great importance that the elastic bandage should extend from the level of the sixth or seventh rib to Poupart's ligament, so as thoroughly to support the abdomen; otherwise, the bandage is almost certain to prove worse than useless.

To patients suffering from this affection, all forms of exercise involving active or sudden movements of the body, such as running, dancing, jumping, or travelling over rough roads, must be strictly forbidden, and even long continued standing, or much walking should be avoided. The following remarks by Dr. Roberts are of value:—

"If there be anæmia, or other disorder of the general health, the removal of this by appropriate remedies is of course to be attempted. Restoration of the tone of the abdominal muscles, which, in most cases, are relaxed and flaccid, is probably the most effective means of reducing to a minimum the inconveniences which attend on mobility of the kidneys. To this end, ferruginous and other tonics, and shower baths, with avoidance of fatiguing exercise, seem to be the means best adapted. A curious case is recorded by Dr. Hare, in which the mobility of the kidneys was markedly diminished after two pregnancies; the steady pressure of the gravid uterus having apparently acted as a mechanical support to the dislodged organs.

"The regulation of the bowels is a point to be carefully attended to. Accumulation of fæcal matter in the large intestines invariably aggravates the inconveniences of movable kidneys. Tight lacing and all violent modes of exercise (equitation, dancing) should of course be strictly forbidden.

"When the symptoms of so-called strangulation of the kidney occur—violent pains, sickness, frequent micturition, enlargement and excessive tenderness of the tumour—complete repose, in the recumbent posture, should be prescribed during the attack; hot poultices, or even leeches, should be applied over the seat of pain, and morphia administered internally."

Inasmuch as the absorption of the paranephric fat, either as a part of general emaciation, or independently of it, is probably one of the causes of movable kidney, in addition to wearing a belt and pad the patient should have a fat-producing diet with the aim of increasing the amount of adipose tissue around the kidney. This is, however, difficult to attain in many cases, on account of the gastric disturbance.

There are instances where the patient cannot bear any form of mechanical appliance on the abdomen; pressure seems, in fact, to increase rather than alleviate the symptoms, and even when the bandage is permissible, it cannot be expected to do more than temporarily fix the kidney. The organ is fixed so long as the pressure is applied, and is thereby prevented from coming in contact with, or dragging upon, other parts within the abdomen, and in this way the pain and uneasiness are, for the time being, relieved. To some the relief is but partial, and to many it is but temporary. The surgeon is, therefore, sometimes forced to consider the question of operative interference. When severe symptoms are not ameliorated by other means, or if the patient has comparative comfort only when strict attention is paid to certain conditions, the irksomeness of which renders life miserable and useless, then the urgent demands of the patient make it necessary that something should be done to cure the disease, or palliate suffering. Some authorities regard operative interference as unjustifiable, whether the operation consists of removing the organ by abdominal section or by an extra-peritoneal incision in the lumbar region, or of the milder course of transfixing, and stitching the kidney to the abdominal wall. When the patient is able to move about, or sit up in comparative comfort, with the assistance of an elastic bandage, then an operation should not be thought of. But it is otherwise when little or no relief is derived from milder modes of

NEPHRECTOMIES PERFORMED FOR MOVABLE KIDNEY.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	xii. '70.	Gilmore. *Harris' Statistics.*	F., 39	Lumbar.	Painful movable kidney.	–	Kidney shrunken and atrophied; woman five months pregnant.	—	R.
2	24. iii. '78.	Martin (Berlin). *Arch. f. Klin. Chir.*, xxiii, 520.	F., 49	Abdominal.	Right painful movable kidney.	8 years.	Removed kidney, normal; cystitis after operation.	—	R.
3	25. viii. '78.	Do.	F., 30	Do.	Do.	5 months.	Kidney normal.	—	R.
4	14. xi. '78.	Do.	F., 25	Do.	Do.	—	Kidney atrophied.	—	R.
5	19. iv. '79.	Martin (Berlin). *Berlin Klin. Woch.*, xix, 82, 10.	F., 37	Do.	Do.	—	Kidney hypertrophied; death from collapse.	D.	--
6	3. vi. '79.	Smyth (New Orleans). *Med. and Surg. Jour.*, Aug., 1879.	F., 35	Lumbar.	Do.	8 years.	Kidney normal.	—	R.
7	24. vi. '79.	Martin, *l.c.*	F., 40	Abdominal.	Do.	—	Kidney normal; patient died from septicæmia.	D.	—
8	17. vii. '79.	Martini (Hamburg). *Arch. f. Klin. Chir.*, xxvi, 513.	F., 37	Do.	Do.	1 year.	Removed kidney, healthy.	—	R.
9	24. x. '79.	Merkel (Nüremberg). *Aerz. Intelligenz blatt.*, xxvi, 221.	F., 28	Do.	Do.	—	Died from uræmia on the fifth day. Fatty degeneration of right kidney, and fatty infiltration of liver and left kidney.	D.	—

10	20. vii. '80.	Martin, *l.c.*	F., 62	Do.	Do.	—	Chronic peritonitis; died six weeks after operation.	D.	—
11	28. xi. '80.	Martin, *l.c.*	F., 67	Do.	Do.	—	Kidney hypertrophied.	—	R
12	1880.	Langenbuch (Berlin). *Centb. f. Chir.*, 1881, xx. Beilage, p. 44.	F., 30	Do.	Do.	—	Kidney hypertrophied.	—	R
13	—	Langenbuch, *l.c.*	M., 20	Do.	Do.	—	Kidney normal.	—	R.
14	17. viii. '81.	Billroth (Wien). *Wien. Med. Woch.*, 1884, xxiv, 742.	F., 28	Do.	Cancer of stomach.	3 years.	Peritonitis and pleurisy; died eight days after the operation from septicæmia; movable kidney, normal.	D.	—
15	30. i. '82.	Clementi (Catania). Private information.	F., 28	—	Right painful movable kidney.	—	Kidney normal.	—	R.
16	3. xi. '82.	Polk (New York). *New York Med. Jour.*, 1882, ii.	F., 19	Extra peritoneal; Poupart's ligament.	Left painful movable kidney.	—	Congenital displaced kidney; died on eleventh day from uræmia.	D.	—
17	29. iv. '83.	Walker. *Brit. Med. Jour.*, 1883, i, 615.	F., 42	Abdominal incision.	Do.	6 years.	Movable kidney, with cystic degeneration.	—	R.
18	19. xi. '84.	Geyl (Dordrecht). *Jong's Statistics.*	F., 35	Abdominal and lumbar.	Dislocation of kidney.	24 days.	Death on twelfth day from œdema glottidis.	D.	—
19	1885.	Orlowshi. *Gaz. Tekasska*, 1885, No. 17.	F., 37	Abdominal section.	Movable right kidney; hæmaturia.	6 years.	Diagnosis confirmed; retention of urine followed operation.	D.	—
20	31. iii. '85.	Terrier. *Brodeur, Thèse de Paris*, 1886, p. 32.	F., 24	Abdominal.	Left movable kidney.	2 years.	Right kidney degenerated and ureters dilated.	D.	—

NEPHRECTOMIES PERFORMED FOR MOVABLE KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
21	20. v. '85.	Lawson Tait. *Birm. Med. Rev.*, Sept. 1885.	F., 22	Abdominal.	Right kidney movable.	1 year.	Right kidney atrophied, and granular degeneration.	—	R.
22	14. vii. '85.	Lucas Clement. *Brit. Med. Jour.*, 25th July, 1885.	F.	Lumbar.	Right kidney movable.	—	Kidney normal; calculus in pelvis of kidney.	—	R.
23	ix. '85.	Hingston. *Med. News*, 7th Nov., 1885.	F., 18	Lumbar.	Left movable kidney.	—	Kidney cystic; ureters dilated.	—	R.
24	20. xii. '85.	Péan (Brodeur).	F., 22	Abdominal.	Right kidney movable.	5 years.	—	—	R.
25	1885.	Agnew. *Philadel. Med. Times*, June, 1885.	M., 32	Lumbar.	Painful right movable kidney.	7 years.	Unsuccessful nephrorraphy was performed in 1884; kidney normal.	—	R.
26	1885.	Hennig. *Memorab.*, 14th May, 1885.	F., 50	Abdominal.	Painful right movable kidney.	—	Right hypertrophied.	—	R.
27	18. i. '86.	Péan (Brodeur).	M., 40	Lumbar.	Displaced kidney.	—	Kidney normal.	—	R.
28	13. v. '86.	Polaillon. *Bull. de Acad. de Med.* 2nd S., xvi, 1886.	F., 35	Abdominal.	Painful right movable kidney.	5 years.	Kidney normal.	—	R.
29	—	W. Gill Wylie. *Med. Rec. N. Y.* 1883, xxiv, 583.	F., 34	Abdominal.	Movable kidney.	—	Tuberculous displaced kidney, with danger of strangulation.	—	R.
30	—	March (H.) *Brit. Med. Jour.*, 1887, i, 282.	25	Abdominal and Lumbar.	Movable kidney, with calculi.	—	Movable kidney atrophied, and containing two small calculi.	—	R.

treatment. When severe pain is experienced, extending to the lower part of the abdomen, and felt also in the course of the crural nerves, in the loins, thighs, and genitals, increased by any exertion, or even by movements in bed, sometimes amounting to paroxysms resembling nephritic colic, and occasionally accompanied by fainting, sickness, and persistent vomiting, then I do not see why the only chance of relief should be denied to the unfortunate sufferer.

Keppler claims that a movable kidney is a continual menace to the life of the patient, and that the danger should be removed by the excision of the organ as soon as detected. Landau, on the other hand, believes that it seldom threatens life, and regards nephrectomy as unjustifiable. Of late years, great advances have been made in regard to operations on the kidney, but still the mortality from nephrectomies is very high. It must not be forgotten, however, that in many of the cases operated upon one or both organs were the seat of organic disease; and it is well to bear in mind that, when the excision is performed in such cases, the increased power of secreting urine is not demanded from a healthy kidney, where compensatory hypertrophy may be readily established, but from an organ probably unable to perform more than its own share of the work. Nephrectomy for organic disease is one thing, extirpation of the kidney, on account of its mobility, is another.

The foregoing table shows the number of nephrectomies performed for movable kidney. Of these 30 operations, 21 patients recovered, and 9 died. In 17 cases the excised kidney was normal. Abdominal nephrectomy was performed 24 times (this includes two cases in which both the lumbar and abdominal incisions were employed), and the lumbar operation was adopted in the 6 remaining cases.

Of the former, 3 deaths occurred as a consequence of uræmia or suppression of urine, 2 from septicæmia, while collapse, chronic peritonitis, œdema glottidis, and retention of urine each accounts for 1 death. The case of Dr. Polk should hardly be included in the statistics of abdominal nephrectomies, the operation, strictly speaking, being an extra-peritoneal one, and the movable kidney the only one of which the patient was possessed. All the patients, upon whom lumbar nephrectomy was performed, recovered. The mortality, 30 per cent, although not so high as in nephrectomies performed for other diseased conditions, is sufficient to prevent extirpation of the kidney being resorted to, except in extreme cases. It is a fact worthy of note that in the 10 cases last recorded there have been no deaths.

For many years it has been a recognised fact that animals can live, without their health being impaired, after one of their kidneys has been excised, so long as the remaining organ is healthy. It has also been satisfactorily shown that a man can afford to lose one half of his urine-secreting tissue. When one kidney is excised, as a rule, the urine is immediately diminished in amount by a half; but if the other kidney be healthy, its secreting power is greatly increased, so that, within a few days, a normal quantity of urine is excreted.

In cases of movable kidney, where the organs are the seat of organic disease, unless the diseased condition be strictly limited to the movable kidney, the operation seems unjustifiable, on the ground of the very high mortality; and where the case is one of uncomplicated movable kidney, then extirpation should not be thought of till nephrorraphy has been tried and failed. It is not right to excise such an important organ as the kidney, before making an endeavour to save it by a less heroic operation. Excision should only be employed when all other measures have failed, and life is seriously threatened.

Within the last few years, nephrectomy, as an operation for movable kidney, has been superseded by a much more successful surgical procedure—namely, nephrorraphy.

When I saw my first case of movable kidney, in 1880, with Dr. Yair, I proposed not to excise the kidney—an operation I then knew to have been done several times for the disease from which she was suffering—but to stitch it to the abdominal wall. At that time, however, I did not feel justified in urging her to have the operation performed, as I still entertained some hope of relief being derived from external appliances, and, besides, the operation of nephrorraphy had then never been performed to my knowledge. Stitching the kidney, by means of sutures, to the abdominal wall, seemed in itself a less dangerous operation than excision.

About a year after this, Dr. E. Hahn published, in the *Centralblatt für Chirurgie* for 23rd July, 1881, his first two cases—"In one case there was a strong suspicion that in one kidney, and possibly not the floating one, there was a calculus, while in the other, both kidneys were movable."

His first operation was performed, in April, 1881, upon a woman, æt. 38, unipara, who suffered from severe pain, associated with movable displacement of the right kidney, and with a suspicion of a renal calculus on the right side. In the second case, the patient suffered from similar symptoms, and both kidneys were found to be movable, the right, however, more so than the left. The first case was quite successful, the second partially so.

The operation consisted of cutting down upon, but not opening, the capsule of the kidney, by an incision made along the edge of the sacro-lumbalis muscle, from the lowermost rib to the crest of the ileum. The adipose capsule was drawn into the wound and stitched to the muscle and fascia by six or eight catgut sutures.

In one of his cases the kidney became movable after the operation, so that Dr. Hahn now recommends more secure fixation by opening the capsule and stitching it to the more superficial tissues at a point corresponding to the lowest limit of the area of mobility, so as to avoid straining the adhesions when the patient stands upright.

The operation performed by Dr. Hahn seemed capable of removing all the disagreeable symptoms resulting from mobility of the kidney; by the posterior incision, the peritoneum was not opened, and above all the patient was not deprived of any of her urine-secreting tissue. The only fault the operation appeared to have was that it did not fix the kidney securely enough, as in one of the cases the organ became again slightly movable after the operation, and for this reason Dr. Hahn recommended that the capsule should be divided, and the edges secured to the surface of the wound.

In cases where the kidney is not movable within its adipose capsule, but simply floats about behind the peritoneum, an operation such as Hahn has performed may be sufficient, but when the adipose capsule has become separated, and forms a sac in which the kidney moves freely, something more requires to be done.

In my first case, I found, that on opening the adipose capsule, the kidney was easily pushed backwards and forwards within it. I there found it not only necessary to stitch the edges of the open capsule to the wound in the abdominal walls, but also, in order to secure the kidney, to pass two sutures through the cortex, and fasten them externally by means of buttons. The details of this operation will be found in the *Glasgow Medical Journal* for August, 1883.

The objects in such an operation appear to me to be (1) to reduce the size of the cavity in which the kidney moves, (2) to fix the kidney, and the walls of the sac, to the abdominal parietes, and (3) to form adhesions between the kidney and the capsule surrounding it. When the adipose capsule is very loose, and the kidney moves freely within it, a portion of the capsule should be removed before stitching its edges to the wound in the parietes; by doing this the cavity is reduced in size, and the chances of future mobility are thereby lessened. The divided capsule should be stitched firmly, either to the deep or to the superficial edges of the wound in the loin, by not less than eight chromic catgut sutures, and two strong sutures of the same material should be passed through the abdominal walls, then through the cortex of the kidney, and out again through the muscles, fascia, and skin, on the other side of the incision. The sutures passed into the kidney become destroyed more rapidly than elsewhere; the living renal tissue seems to have an unusual power of absorption. I found that the portions which passed through skin, fascia, muscle, and even granulation tissue, were firm and strong, whereas the parts which had been in contact with the renal tissue were softened, and partly absorbed. It is therefore necessary to use a strong suture, and one that has been kept for a long time in chromic acid, for operations where the kidney is involved in the stitch.

With the object of forming a firm union between the parts, it is well to allow any blood which may escape after the adipose capsule has been opened to remain in the latter, and so fill up any space that may be left between it and the kidney. When the case is kept aseptic, the blood clot readily becomes organised into connective tissue, and so forms a bond of union between the adipose capsule, the kidney, and the granulation tissue uniting the two edges of the wound. The deep edges of the wound should be kept wide apart by a large drainage tube, so as to allow a considerable mass of granulation tissue to form between these surfaces, and the convex surface of the kidney.

Up to the present time, the operation of nephrorraphy has been very successful. Nephrorraphy has been practised 23 times. The operators were—Hahn, in 5 cases; H. Morris, in 2 cases; Agnew, Bassini, Ceccherelli, Dunning, de Paoli, Esmarch, Gardner, Ghanozzi, Gilmore, Jurié, Kuester, Svensson, Greig Smith, Von Bergmann, Weir, and myself, each in 1 case. Of these 23 cases all the patients recovered with the exception of 1 (Ceccherelli's), who died from collapse 45 hours after the operation. The autopsy revealed the presence of 300 grammes of fluid in the left pleura, slight atheroma of the aorta, but the kidneys were practically normal. The operation, therefore, must be regarded as a safe one, and this comparative freedom from danger the mortality being only 4·3°/₀, warrants the conclusion that extirpation of the kidney should never be attempted for movable kidney, however grave the symptoms may be, until nephrorraphy has been performed and failed. This was the practice followed by Agnew, who, in his case of nephrectomy performed in 1885, had operated unsuccessfully by nephrorraphy in 1884.

Nephrorraphy, as an operation for fixing the kidney in position, has not been so successful in its ultimate results as was at one time anticipated, the organ in some cases breaking away, and again becoming freely movable. This failure I believe to be largely due to the incompleteness of the operation, the surgeon being in many instances satisfied by stitching the capsule of the kidney to the abdominal wound, whereas in order to have a firm and complete adhesion, it is necessary to divide the fibrous capsule, stitch its free margins to the wound in the parietes, and while the external lips of the wound in the abdominal wall are accurately brought into position to encourage healing, the deeper parts should be kept separate by a drainage tube, in order that a considerable mass of granulating tissue may exist between the exposed surface of the kidney and the deep parts of the wound. By so doing, a strong and firm cicatrix is formed which binds the kidney in position.

The advantages of nephrorraphy over extirpation of the kidney, are numerous, and may be briefly stated:—

1. In the operation of nephrorraphy the organ is not removed, so the secreting tissue is not diminished in amount as it is in excision, and there is therefore no danger of removing, as has been done, the only kidney the patient may be possessed of.

2. The mortality in excision, even in cases where the remaining kidney was healthy, is not very encouraging (30 per cent), whereas in 23 cases operated upon by nephrorraphy there was only one death.

3. Nephrorraphy may be performed when both kidneys are movable, or when one is diseased. In one of Hahn's cases the kidney, which was not displaced, contained a calculus. This did not prevent the operation being successful.

4. In stitching the kidney to the abdominal wall the peritoneum is not opened, as it is in the anterior operation for excision, where the membrane is incised at least twice.

5. Extirpation is only permissible when nephrorraphy has failed, and the patient's life is still seriously threatened, when the movable kidney is diseased, or the fixed kidney healthy.

In all cases where excision of a kidney is contemplated, the most careful examination should be made regarding the condition of the kidney on the opposite side, and where it is at all practicable the ureters should be catheterised, as the most certain means of determining whether or not the remaining organ is healthy.

In women catheterisation is very easy, while in men compression of the ureters may be practised without great difficulty. Compression is not so reliable as passing a catheter, but in the male the practical difficulties of the latter operation are very great.

Floating Kidney.

At the beginning of this lecture, displacements of the kidney were divided into two forms. In one, the organ was described as being movable behind the peritoneum (movable kidney), in the other, the kidney was attached to the spine by a meso-nephron, and lay within the cavity of the peritoneum, where it might move to the extent of its mesentery (floating kidney).

Objections may be raised to this division of the subject, seeing that, as a matter of custom, both the terms are used synonymously by most writers, and that, clinically, the diseases are not distinguishable from one another. It is only after the abdomen is opened that the presence or absence of a meso-nephron can be demonstrated. It is necessary, however, from the surgical standpoint, particularly when operative interference is contemplated, carefully to separate the two conditions from one another. In movable kidney, the organ can be exposed without opening the peritoneum, whereas, in floating kidney, it cannot. These varieties of displacement are recognised, not only by being distinct anatomically, but also by their etiology being different. Floating kidney is always a congenital condition, whereas movable kidney is usually acquired. Oppolzer and the earlier writers on the subject looked upon elongation of the renal vessels as a proof of the affection not being acquired; they, however, did not distinguish between the two forms, but grouped all displacements of the kidney associated with mobility in one class. The etiology of movable kidney has been already fully discussed. It will now be necessary to make only a single remark regarding the causation of floating kidney.

Cases where the kidney moves by reason of the existence of a meso-nephron are very rare, so uncommon, indeed, that such writers as Lawson Tait and Jago are disposed to doubt the possibility of such an occurrence. That it may exist has been already shown; it is not necessary, therefore, again to discuss the question.

Floating kidney, as already stated, is always a congenital condition, and the existence of a meso-nephron is not uncommonly associated with other malpositions of the peritoneum, or of other abdominal organs. The following case, reported by Mr. Durham, illustrates this point:—

"Upon opening the abdomen of J. C., æt. 34, it was at once noticed that the left kidney was situated lower down and nearer the middle line than usual; the descending colon was also nearer the middle line, and formed no sigmoid flexure in the left iliac fossa, but passed across the last lumbar vertebra, and entered the pelvis on the right side of the sacrum.

"Upon slightly pressing the kidney, it slipped at once into its normal situation, and upon further examination it was found to be movable to a most remarkable extent. By changing the position of the body, or by gentle manipulation, the kidney was caused to pass, according to circumstances, quite up under cover of the ribs, across to the front and slightly to the *right* side of the bodies of the vertebræ, or down into the iliac fossa. This mobility appeared to depend principally upon the unusual disposition of the peritoneum, which was associated with the misplacement of the colon. Instead of passing over the anterior surface of the kidney, and then forming the descending meso-colon, the peritoneum from the side of the spinal column only just touched the lower part of the inner border of the kidney, and then, having been reflected over the descending colon, touched the lower part of the outer border of the kidney, as it passed on to line the side of the abdominal cavity; and again, the 'lesser sac of the peritoneum' extended behind the spleen, and as low down as the upper border of the kidney. Thus, the kidney, instead of being fixed in its position by a single layer of peritoneum over its anterior surface, was placed, as it were, in the middle of three diverging layers, none of which could afford much support.

"Before any of the viscera were injured or removed, the trunk of the subject was exhibited to the Society, and careful diagrams were made of the disposition of the viscera, and of the various positions which the kidney could be made to assume by mere motion of the body.

"Upon dissection, it was found that there was little or no fat in the lumbar region, and that the kidney was consequently only surrounded by very loose cellular tissue. To this circumstance, doubtless, must be attributed, in great part, the remarkably prominent appearance of the kidney when the abdomen was laid open. The renal artery was somewhat longer and thinner than usual. The kidney itself was rather small, but of perfectly healthy structure. No other anatomical peculiarities than those already described were met with. No history of the recognition of the mobility of the kidney during life could be obtained."

It would, indeed, be difficult to explain how a mesonephron, properly so called, could be formed otherwise than congenitally, unless by supposing that the displaced kidney has pushed before it a fold of peritoneum, the surfaces of which have become adherent around it, and united to each other along the line of the renal vessels. That such a condition might arise as a result of localised peritonitis seems possible; there are, however, no cases recorded where there is any evidence of this having taken place. When inflammation has occurrred in cases of movable kidney, it has in most instances led to an adhesion of the layers of the peritoneum, not only to the kidney and to one another, but also to the surrounding parts, the result being that the kidney ceased to be movable, and became fixed in an abnormal position.

The point of importance to be attended to, in connection with floating kidney, is that it cannot be reached by an operation from behind without opening the peritoneum, and is therefore not so favourable for nephrorraphy as movable kidney. This should be borne in mind while operating. It is not possible, however, previous to the operation, to distinguish, by physical examination, the two conditions.

Some authorities have expressed the opinion that floating kidney is more freely movable than movable kidney, and use this as a basis for diagnosis. This is an error. In not a few cases of movable kidney, the organ can be pushed with perfect freedom up under the ribs, down into the pelvis, and for a short distance across the middle line. What greater freedom of movement could be shown? It is true that in some instances of movable kidney the excursion may be limited to an up-and-down motion in a plane parallel to the lumbar muscles. This is seen when the sac in which the kidney moves is formed by the adipose capsule, without the capsule being detached from its seat behind the peritoneum. Where, however, the peritoneal covering has become raised from the posterior abdominal wall, less impediment is offered to movement, and so what was clearly at first a case of movable kidney gradually may assume the physical signs of the more mobile form, and may pass, according to some observers, from the class of movable kidneys into that of floating ones.

Fortunately, floating kidney is a very rare condition, but nevertheless it must not be entirely overlooked where an operation is contemplated for the cure of the more common variety of displacement with mobility.

LECTURE II.

In studying general symptomatology attention is limited to the presence of blood or pus in the urine, and the existence of pain or swelling in the renal region. Differential diagnosis of sources of hæmorrhage in various forms of hæmaturia. Significance of pyuria, and diagnosis of the source of origin of the pus. Distinguishing characters of pain in the renal region in different diseases. Diagnosis of swelling due to enlargement or distention of the kidney.

GENTLEMEN,—We all know that symptoms are the language of disease, and that the various organs of the body, according to their situation and function, have different means of communicating to us the fact that they are diseased. It may be well, therefore, at the present stage, to study the special phenomena which form the symptoms of the diseases of the kidney, now being discussed in this course of lectures.

In doing so, I will eliminate the less important and least significant features of the diseases, and ask you to concentrate your attention upon two main facts—(1) the presence of blood or pus in the urine, and (2) the existence of pain or swelling in the renal region. Many causes of hæmaturia do not come under our consideration, as they belong strictly to purely medical practice. For example, hæmaturia may be an accompaniment of hæmophilia, acute nephritis, active or passive hyperæmia of the kidney, septicæmia, typhus, enteric, or malarial fevers, small-pox, scurvy, or purpura; or it may be the direct consequence of poisonous agents, such as cantharides, alcohol, turpentine, phosphorus, and arsenic.

Eliminating such sources of hæmorrhage, and considering only those of a purely surgical nature, it may be said that the presence of blood in the urine indicates disease in some portion of the urinary tract. The red corpuscles may escape from the capillaries of the kidney and become mixed with the urine as it is secreted, or the urine may escape from the collecting tubes in a normal state, and afterwards become tinged with blood from the calices, ureters, bladder, or urethra.

How, then, are we to form a differential diagnosis of the source of the hæmorrhage.

This may be done in several ways—

1. By observing the physical characters of the urine and of the blood clot.

2. By estimating the quantity of hæmoglobin and comparing it with the amount of albumen in the urine.

3. By collecting the urine separately from the two ureters.

4. By carefully considering all other accompanying objective and subjective phenomena.

In acute diseases, the diagnosis between hæmaturia of renal and that of vesical origin is usually easy, but it is frequently otherwise in chronic affections. In the former the objective and subjective phenomena are so pronounced as clearly to indicate the organ which is affected; in the latter the most careful observation of minute details is often necessary in order to determine the seat of the lesion; and, in not a few instances, examinations conducted by different observers may lead to disagreement as to whether the secreting, conducting, or collecting portions of the urinary system are at fault.

I shall now endeavour to sketch, under the divisions just enumerated, a systematic enquiry respecting the signs or symptoms accompanying hæmaturia, in so far as they may lead one to a differential diagnosis of the source of the blood.

Physical examination of the urine and of the blood clot.—The first questions to be asked are:—What is the colour of the blood? Is it intimately mixed with the urine? Is the quantity of blood augmented by exercise? Have clots been seen, and what was their form?

As a general rule, the nearer the source of hæmorrhage is to the external orifice of the urethra the less is the blood altered in appearance. Hence blood from the urethra is almost pure, and may escape independently of micturition, and unless the blood has passed back from the urethra into the bladder, the urine, after the first ounce or so has been evacuated, is clear and bloodless. On the other hand, when the hæmaturia is of vesical origin, the first quantity of urine excreted may present a normal appearance, especially if the patient has been for some time at rest in the recumbent posture, but as the bladder empties itself, the urine gradually becomes more and more tinged, till finally the last few drops may be almost pure blood. As a general rule, in hæmorrhage from the bladder, the urine is mixed with a considerable quantity of mucus, and is of a bright florid colour; but if long pent up in the viscus it may assume a dark colour, dependent upon the action of the urine, which, in such cases, is usually alkaline. When due to vesical calculus, the hæmorrhage is increased by exertion, and in cases of tumour of the bladder the bleeding is almost always worse after an attempt has been made to examine the bladder by instruments, and, in not a few instances, the tumour may be detected by digital examination. When the blood is from the kidneys or ureters, it is nearly always intimately mixed with the urine, to which it imparts a dark smoky colour, unless when, in a few instances, the blood issues in considerable quantity from the pelvis of the kidney, flows rapidly along the ureter, distends the bladder, and escapes without having undergone much change.

Blood having escaped from the vessels, its fibrinous constituents may coagulate into firm clots, which, during their formation, may entangle some of the histological elements of the structures in which they lie, or by their form, appearance, or bulk indicate the exact source of the hæmorrhage. If bleeding takes place elsewhere than in the substance of the kidney, the clot may be of considerable size. When the clot is large, the hæmorrhage is invariably from the bladder; the clots may be so huge that they cannot pass through the urethra without being broken up either by the repeated contraction of the bladder, or by means of instruments. The coagulum may make a complete cast of the pelvis or of the calices. Rounded clots corresponding to the diameter of the ureter may escape, or leech-like ovoid casts may be taken of the first part of the urethra, or long bougie-like coagula from its anterior part. While, however, the presence of considerable clots is usually conclusive against hæmorrhage from the secreting substance of the kidney, the absence of clots visible to the eye proves nothing. In renal hæmaturia minute coagula, blood-casts of the uriniferous tubules, may, by the microscope, be discovered in the urinary sediment, and may give evidence by their form and shape whence they are derived. In this form of hæmaturia the number of blood corpuscles is no criterion of the quantity of albumen in the urine, whereas, in hæmorrhage from the conducting or collecting portions of the urinary tract, provided there is no pus in the urine, the number of red corpuscles or the amount of hæmoglobin may be accepted as a measure of the quantity of albumen contained in the excretion.

Urine containing blood is always albuminous, but the relative proportion existing between the red corpuscles and the serum depends upon whether or not the hæmorrhage is associated with inflammation. For example, in acute nephritis, not only do the elements of the blood escape from the injured part, but the general inflammatory hyperæmia causes a large quantity of albumen to pass into the urine independently of the hæmorrhage. *The relationship between the quantity of hæmoglobin and the amount of albumen* in the urine will, therefore, aid one in determining the seat of the hæmorrhage.

Some years ago I devised an apparatus for estimating, by a simple method, the quantity of hæmoglobin in solutions, and showed it at a meeting of the Glasgow Pathological and Clinical Society in 1880.

When homogeneous white light is passed through a solution containing a small quantity of blood pigment (hæmoglobin), the spectrum, instead of being continuous, is seen to be intersected by dark absorption bands. The presence of these bands affords a means of detecting the presence of hæmoglobin, and of estimating it quantitatively. Blood pigment exhibits a very characteristic absorption spectrum. Hæmoglobin, while in a very dilute solution, gives two absorption bands—one in the orange and another in the green portion of the spectrum, between Frauenhofer's D and E lines. The one next D is narrower, blacker, and more sharply defined than the band close to E, and, on diluting the solution, it is the last to disappear. The former is still present when a solution containing 1 part of hæmoglobin in 22,000 parts of water is examined, the stratum being equal to two centimetres in thickness; while in so dilute a solution the band next E is no longer apparent. The point at which the band next E disappears having been determined, we have a means of estimating the percentage of blood-colouring matter in the solution.

The instrument which I use for this purpose is somewhat similar to the hæmatoscope employed by Hermann. It consists of a brass tube about 10 cm. long and 2 cm. in diameter; one end is closed by a glass plate, and into the other extremity a sliding water-tight piston is introduced. This piston consists of a smaller brass tube, the inner end of which is also closed by a glass plate, while into the other end a small spectroscope is introduced. By passing the piston into the larger tube, a cell is formed (by the walls of the outer tube and the two glass plates), the depth of which may be modified within certain limits by sliding the piston out and in, and the thickness of the enclosed stratum of fluid may be measured by means of a scale engraved upon the inner tube. The fluid to be examined is passed into the cell through a hole in the outer tube close to the glass plate.

Suppose we wish to estimate the percentage of hæmoglobin in a solution, we know, to start with, that in a solution containing 1 part of hæmoglobin in 22,000 parts of water we lose the absorption band next E when the stratum is 2 cm. thick. Now, if the solution be more concentrated, we cease to see the band next E with a thinner, and if it be less concentrated, with a deeper stratum, the depth of the layer being in an inverse ratio to the concentration of the solution; therefore, by a simple calculation, the quantity of hæmoglobin may be estimated. When the solution contains more than ·1 per cent of hæmoglobin, it is necessary to dilute it so as to make the observation more exact.

Now, if 1 cc. of defibrinated blood be added to 100 cc. of urine, the mixture will be found to contain ·124 per cent of hæmoglobin and about ·078 per cent of albumen coagulable by heat. You will observe that, while the quantity of blood is sufficient to impart to the urine a dark red colour, there is an extremely small quantity of albumen. This simple experiment prepares one for the fact observed by clinical experience, that the admixture of blood with the urine, after it has been secreted, is not associated with any considerable albuminuria.

The quantity of hæmoglobin having been estimated by the method I have just described, and the amount of albumen determined by one or other of the recognised processes, the two results should be compared. If the ratio of albumen to hæmoglobin is as 1 to 1·6, then it may be concluded that the appearance of albumen is entirely due to the presence of blood; but if the quantity of albumen is much increased beyond the proportion just mentioned, the indication is in favour, not only of an independent albuminuria, but also points to a renal affection as the cause of the hæmaturia.

Beyond demonstrating the presence of blood-casts of the uriniferous tubules, the microscope may reveal the existence of other elements of consequence in the deposit. For example, the character of the epithelium as derived from the renal parenchyma, from the pelvis, the ureter, or the bladder may greatly assist one in diagnosis; or, on the other hand, should the urine contain small fragments of tumours, parasites, or bacteria, the hæmorrhage may be explained. The significance of crystalline deposits will be considered when I come to speak of the formation of calculi.

Collecting the urine separately from the two ureters is, when practicable, the most certain means of ascertaining the seat of origin of the blood. I shall not occupy your time at present explaining the mode of procedure in catheterisation of the ureters; it will be described in a future lecture. I shall satisfy myself by citing a case in illustration. I select this case as a particularly interesting one. The patient, who resides in a large provincial town in the North of England, came to Glasgow to consult me regarding a hæmaturia from which he had been suffering for the last nine years. As given by the patient, who is most intelligent, the history, although clearly stated, led several different surgeons whom he had consulted to diverse opinions as to the cause of the hæmaturia. A careful examination of the urinary bladder failed to detect the presence of a stone. The diagnosis then seemed to me to be between renal calculus and tumour in the bladder. The question arose—Was the blood from the bladder or from the kidney? The general characters of the hæmaturia were certainly more like vesical than renal hæmorrhage; but on catheterising the ureters, I found that all the blood flowed from the right kidney. This is one of the few instances in which I have succeeded in passing catheters into the male ureters: compression is an easier operation, but its results are not so reliable. By examining the urine from the two ureters I was satisfied that the hæmaturia was due to a calculus in the right kidney, and was able to advise the patient to have an operation performed.

The consideration of all other accompanying objective and subjective phenomena is of great importance. It is unnecessary here to enquire into the diagnosis of hæmaturia arising in the course of acute diseases, as bleeding from such causes is not likely to be confused with hæmorrhage as a consequence of the diseases which will come under our consideration.

Placing aside for the present the hæmaturia due to hydatid disease the renal hæmorrhages of the greatest practical importance from our standpoint are those arising from injury, renal calculus, tumours of the kidney, and tubercular disease of that organ. Having determined that the hæmorrhage is not from the lower urinary tract, we must ascertain which of those four causes is to blame.

When the hæmorrhage is due to renal calculus, it is usually small in amount, constantly present or oft repeated. In some instances, however, the hæmaturia is very slight, while in other cases it may be the only symptom. The bleeding is not closely related to pain or the development of other symptoms; but, as a rule, it is increased by movements of the body. This, however, does not always follow immediately, but a short interval may elapse—hours, or even days—between the exertion and the appearance of the blood in the urine. While, as I have just said, the hæmaturia of renal calculus is more copious after exercise, rest in bed usually appreciably diminishes it. This peculiarity is most characteristic. The blood, it must be borne in mind, is derived from the renal pelvis, and not from the parenchyma; consequently renal blood-casts are not found in the urine, and the quantity of albumen is fully explained by the presence of blood. When the urine is evacuated, the blood is thoroughly mixed with it, but not so intimately as when the cause of the hæmaturia is structural disease of the kidney; and, if the urine be allowed to stand for a few hours, the blood corpuscles are readily precipitated, and leave the supernatant urine clear. If free from blood, the urine will also be found to be non-albuminous.

The presence or absence of pus in the urine will be determined by the circumstance whether or not the calculus has induced inflammatory changes, and the existence of swelling in the renal region will depend upon the amount of freedom for the escape of urine by the ureter. The value of swelling and pain, as symptoms of renal calculus, will be considered presently.

Renal hæmorrhage from tumour is generally more profuse and less transient than from calculus, and in not a few cases it is so copious as to cause marked anæmia, a result seldom induced by calculous hæmaturia. It is often developed without any preceding pain. In calculous disease exercise, as I have shown you, commonly provokes the bleeding, and therefore one finds the hæmorrhage more profuse during the day, while the patient is moving about. The bleeding from tumours is, on the contrary, most likely to occur during the night, while the patient is at rest in the recumbent posture.

The urinary deposit may assist one in the diagnosis. Concretions composed of oxalate of lime, uric acid, phosphates, or urates, may indicate the character of the stone, while by carefully filtering the urine in cases of tumour, portions of the growth may be procured for microscopic examination.

The presence of a persistent swelling in the renal region associated with considerable hæmaturia is of significance, and may be held as clearly indicating the presence of a neoplasm in the kidney. Exceptions to this rule have, however, been recorded by Ebstein, Hirtz, and Fleming. But while this is so, it must not be forgotten that the presence of a palpable new-formation, may, for a considerable time, be preceded by the presence of blood in the urine. Considerable distension of the pelvis may be produced by a calculus obstructing the ureter, and so lead to a swelling in the renal region, or the bulging in the loin may be caused by enlargement of the kidney from tubercular disease; in neither of those conditions, however, does hæmaturia frequently occur. In the latter the very obstruction which causes an increase in bulk of the kidney prevents the hæmorrhage.

Although much difficulty is often experienced in distinguishing calculous hæmaturia from that caused by tumours, there is still greater care required in the diagnosis between the hæmorrhage of early tubercular disease, and that of renal calculus. The symptoms of the two latter conditions are sometimes identical. This is especially so when the patient fails to show any other evidence of tubercular disease than that revealed by the renal lesion. In tubercular disease hæmaturia is frequently absent for long intervals, is seldom so severe as in stone, and is not increased by exercise. In both conditions pus may be mixed with the urine, but while in the latter concretions and gravel may be discovered, in the former careful and repeated search may demonstrate the presence of tubercular bacilli.

In the early stage of tubercular disease of the kidney the quantity of albumen in the urine is generally in excess of that accounted for by the blood, and in the later stages, when pus appears in considerable quantity, the pus and blood are not so rapidly or so completely precipitated from the urine as in calculous pyelitis.

The presence of phthisis pulmonalis, or of tubercular disease of bones or joints, the testicle, prostate, vesiculæ seminales, mesenteric glands, intestine, or the lower urinary tract, may give a clue to the cause of the hæmaturia.

In hæmaturia consequent upon injury of the kidney the urine is generally scanty, and highly coloured with blood, and long thin coagula, casts of the ureters, may be observed. The presence of blood in the urine in such cases does not necessarily denote rupture or laceration of the organ; and, on the other hand, severe injury may be sustained by the kidney without blood at any time appearing in the urine. The latter contingency may arise either as a result of plugging of the ureter by a clot, or as a consequence of rupture of the ureter from the violence which caused the injury to the kidney.

In some individuals very slight concussion may cause hæmaturia, independently of the existence of renal calculus; and in those instances recovery usually takes place within a short time. Sprains of the lumbar region may cause the appearance of blood in the urine. I hold in my hand a kidney I removed from the body of a man who fell from a height of 36 feet, alighting first upon his right foot, and then on the buttock; he dislocated his right hip-joint and ruptured the kidney on the same side. I saw the patient within a few hours of the accident, and then, to the naked eye, there was no appearance of blood in the urine, but within six hours a long narrow clot, probably a cast of the ureter, was evacuated along with a quantity of deeply blood-stained urine. The following day there was a distinct fulness in the flank, corresponding to the position of the right kidney, and the hæmaturia continued, but no more blood clot was observed. The patient complained of a dull aching pain in the renal region; this was increased greatly by deep inspiration or movement of the body, and on palpation there was great tenderness. The patient died of peritonitis on the fifth day, and at the *post-mortem* inspection a considerable quantity of blood was found effused behind the peritoneum and into its cavity, and the cortex of the kidney was ruptured transversely in many places, but not to any great depth.

The hæmorrhage in such cases is easily explained. When the spine is acutely bent upon itself, as it was in the case I have just mentioned, the kidneys, being firmly bound to the column, are made to describe a contortion similar to that of the spine, as a consequence of which, not only may the convex aspect of the organ be lacerated and torn transversely, but the sudden jerk may force the kidney away from the middle line, and tear the pelvis or ureter. The blood may therefore escape in two ways: into the tissues surrounding the kidney, where, if the patient survives, it may give rise to perinephritic inflammation and abscess; or, by passing down the ureter, the blood may give evidence of the injury the kidneys have sustained. But while laceration of the kidney may occur without a bruise in the loin, in the majority of instances a blow upon the lumbar region is the direct cause of the injury.

There is not much diffiulty in diagnosing this form of hæmaturia. The history of a lumbar sprain, or of a blow or crush on the loin, indicated, perhaps, by ecchymosis, leads one to suspect rupture or contusion of the kidney. Severe damage to the kidney may, however, exist independently of any injury to the other abdominal organs, and of itself prove rapidly fatal; but in the great majority of cases there is evidence of violence elsewhere, and symptoms of rupture of other internal organs, especially the spleen and liver. Generally, there will be marked and rapid collapse, pain in the course of the ureters, as well as in the lumbar region, retraction of the testicle, difficulty in micturition, or even anuria.

The *clinical significance of pyuria* in many respects resembles that of hæmaturia, but differs from it in so far that an accurate diagnosis of the portion of the urinary tract from which the pus comes is more difficult to make.

Pus from the urethra, as in hæmaturia from the same situation, escapes independently of micturition, or is only mixed with the first few drops of urine; this fact, together with the presence of pain in the region, is usually sufficient to determine its origin. In such instances the quantity of pus is usually small, and can be expressed from the canal both before and after micturition. It is otherwise in catarrh of the bladder, in which case the pus only escapes mixed with the urine, is more or less abundant, and is accompanied by a number of large vesical epithelial cells. Vesical catarrh is accompanied by considerable pain on micturition, and inability to retain urine for any length of time. To establish the fact that there is cystitis is not sufficient; the cause of the altered condition must be determined. If it has been ascertained that there is no primary disease of the bladder, no inflammation or suppuration of the prostate, no stricture of the urethra or vesical calculus, no pelvic or other abscesses opening into and communicating with the urinary tract, then we must proceed to enquire whether the pus proceeds from one or both ureters, or from the bladder. This may be done by compressing or catheterising the ureters.

Having discovered that pus is flowing with the urine from the ureters, the next point to clear up is the nature of the renal lesion. The diseases amenable to surgical treatment which are characterised by pyuria are pyonephrosis, with or without calculus, suppurative nephritis, tubercular disease, and cystic disease when the cyst has suppurated.

The question may now be asked:—Is there, by observing the urine, any means of distinguishing one form of renal pyuria from another?

When it is a consequence of inflammation of the pelvis and calices of the kidney, being mixed with an acid urine, the pus on standing usually precipitates rapidly, separates clearly from the supernatant fluid, and if a calculus be present, the pus may occasionally be mixed with blood. A careful record must be kept not only of the relative, but also of the absolute quantity of pus, as sudden and marked variation in the amount, is one of the most certain indications of partial or complete obstruction of the ureter, from which the pus is flowing. If disappearance of pus from the urine is associated with increase in the lumbar swelling, and followed by the sudden escape of a large quantity of purulent urine, and subsidence of the swelling, then it is clear that the ureter has been blocked for a time and its patency restored. Previous to the appearance of pus, as the result of calculous pyelitis, the urine is usually observed to contain an abundant quantity of mucus, which forms a bulky tenacious mass. This is especially the case when the calculus is composed of oxalate of lime. When the pyelitis has existed for some time, the quantity of pus increases and the mucus disappears. So long as the urine remains acid, and no vesical disturbance arises, micturition is not unduly frequent, and the urine has not an offensive odour. But if there be frequent or considerable accumulations in the pelvis of the kidney, as a result of obstruction, the fluid so retained is liable to undergo decomposition, become alkaline and glairy, has an offensive odour, and is in almost all respects similar to the urine in cystitis.

The distinguishing characteristics of calculous pyelitis, as I have just indicated to you, are sufficiently distinct to guide one to a correct diagnosis. We may now enquire shortly into the characters of the urine which would lead us to suspect the pyelitis to be of tubercular origin.

In the early stages of strumous pyelitis the urine may be unaltered, or it may be excessive in quantity and albuminous, the amount of albumen being out of proportion to the pus, and not associated with the presence of renal tube casts. The albuminuria also differs from that of Bright's disease, in that the urine is not clear, but contains much mucus, is viscid, cloudy, and opaque. I have already stated to you that intermittence in the discharge of the pus is very characteristic of calculous pyelitis; it is the contrary in suppuration from a tubercular source. There the discharge is almost always continuous, the urine is commonly alkaline, contains small caseous masses mixed with renal *debris*, and on standing, although a considerable amount of pus may be precipitated, a certain quantity remains suspended, and imparts a cloudy appearance to the fluid. The urine being alkaline, vesical irritation is an early result of renal suppuration; so commonly is this the case that, should pus be present in the urine without any indication of vesical symptoms, it may be assumed, almost with certainty, that its presence is not due to a tubercular lesion. Should tubercular bacilli be detected in the urine, the diagnosis is certain, but they are seldom found in the early stage; and in the later stages their absence must not be regarded as evidence that the disease is non-tubercular.

In cystic disease, the urine has the characters of that of chronic interstitial nephritis; it is pale, copious, of low specific gravity, and may contain coarse, granular tube casts. There may be copious hæmaturia, and should the cysts suppurate, pus may appear in the urine. In hydatid cysts of the kidney, echinococci, or hooklets, may appear in the urine.

At the beginning of this lecture I stated that in considering general symptomatology our attention would be limited to two points—(1) the presence of blood and pus in the urine, and (2) the existence of pain and swelling in the renal region. The discussion of the former being now concluded, we proceed to consider how far *pain in the region of the kidney* may guide one in pronouncing a diagnosis. It is not possible to classify surgical affections of the kidney according to presence or absence of pain, for the greatest variation in this respect may be observed in the same disease in different individuals. At the same time, it may be generally stated that simple hydronephrosis, cystic disease, and calculus impacted in the substance of the kidney, are not characterised by much suffering, whereas such diseases as pyonephrosis, suppurative nephritis, perinephritic abscess, tubercular disease, calculus in the pelvis or ureter, and tumours of the kidney usually give rise to considerable pain. In the diseases first mentioned, pain may, however, be very pronounced in individual cases. H. Morris records a case of hydronephrosis operated upon by him, in which, during a period of ten years, the patient had several attacks of severe renal colic lasting for a few days, and relieved by hot fomentations. As a rule, pain is only induced in hydronephrosis when the obstruction to the ureter is complete, or nearly so, or as a consequence of pressure of the distended kidney upon neighbouring structures. In the majority of cases recorded, the patient suffers more from a sense of weight and dragging than from actual pain; but as hydronephrosis is frequently associated with other painful affections, such as cancer of the uterus or bladder, prolapse of pelvic organs, or impacted calculus, an amount of suffering may be attributed to the distension of the renal pelvis, for which it should not be blamed. In cystic disease, pain is undoubtedly rare unless suppuration has set in.

In pyelitis pain, except of a dull dragging kind, may remain absent for a considerable time. It is usually limited to the lumbar region, and is increased on pressure but not by movement. In perinephritic abscess, the pain is severe and lancinating from the beginning, and increases steadily; there is great tenderness on pressure, associated with local elevation of temperature, and rigors, preceding the appearance of swelling or fluctuation. Tuberculosis of the kidney is not characterised by severe pain, but commonly the patient complains of a dull dragging sensation in the loins. The greatest discomfort is referred to the bladder which, when it becomes distended, causes considerable suffering before and during micturition, but the pain is relieved immediately the bladder is empty.

The pain associated with the existence of renal calculus varies according to the situation and composition of the stone, and whether there is or is not pyelitis. It may be stated generally that when the calculus is impacted in the substance of the kidney, and uncomplicated by pyelitis, comparatively little pain is suffered; or severe pain may exist for a time, and then disappear for years. In other cases there is a dull pain almost constantly present in the loin. If the calculus is in the renal pelvis, or permitted to move freely in a cavity within the kidney, pain becomes a more marked symptom, and is not limited to the loin, but extends down the course of the ureter to the testicle, the inner aspect of the thigh, or to the lower part of the limb. When the calculus is so situated, the pain is dependent upon movement, being aggravated by exercise of any kind, or even by movements in bed, while complete rest generally affords marked relief from suffering. The varying pressure of the abdominal viscera, or changes in posture may modify the pain, or palpation either in the back, or on the abdomen may cause it to be temporarily increased. Immediately a stone enters the ureter, renal colic sets in, and the paroxysms coming on without warning, may last for hours or days. The pain is agonising, and radiates from the region of the kidney down the ureter, to the thigh, penis and testicle. When the first sickness and faintness, so characteristic of renal colic, have passed off, the patient may endeavour to relieve himself by contortions in all directions, or may be thrown into convulsions by the fearful agony he is suffering. After a period of great anguish, usually measured by hours, the pain subsides as suddenly as it came on, and the other symptoms accompanying it disappear. If the calculus passes into the urinary bladder, the patient may be sensible of the fact, but if the stone has merely become displaced from the renal orifice of the ureter, another paroxysm may occur at any time. In other cases the calculus remains impacted in the ureter, which becomes more or less habituated to its presence; under such circumstances, although the pain may set in suddenly, it becomes only gradually relieved, and cessation of suffering alternates with paroxysmal attacks, probably caused by spasm of the ureter.

It must be borne in mind that renal colic may arise from any sudden stoppage of the ureter, by disease of its walls, by a foreign body, by pressure from without, or by torsion. Hence we find that although renal calculus is the most frequent cause of severe paroxysmal pain, this symptom may likewise occur in tubercular disease from the passage of a caseous mass, or a plug of mucus, or as a consequence of a tubercular ulcer. In hydatid disease severe suffering may arise from the evacuation of cysts, or in tumours of the kidney, from portions of the growth becoming detached and carried down the ureter.

As shown by Prout—and Dickinson agrees in his opinion—the pain is not equally severe in all varieties of renal calculus. The latter says "that of renal concretions lithic acid produces the least pain, what there is being dull, oppressive, and connected with a sense of weight; oxalate of lime causes pain of a more acute kind, and that often referred to a particular spot over the region of the kidney, and sometimes discursive, shooting in the direction of the ureter, epigastrium, or shoulder." Calculi composed of phosphates are "found to be attended by great suffering—almost unremitting, though paroxysmally aggravated."

Pain such as I have just described must be regarded as one of the most important indications of renal calculus, and may of itself, if sufficiently characteristic and aggravated, justify the surgeon in making an exploratory incision, even in the absence of other symptoms.

Swelling arising from enlargement or distension of the kidney is found in such diseases as hydronephrosis, pyonephrosis, cystic disease, abscess of the kidney, tuberculosis, and in simple or malignant neoplasms. Increase in bulk of the kidney must therefore be regarded as an important sign of disease, and one to which much care must be given; there are few organs, the enlargement of which is so difficult to make out and diagnose as that of the kidney. Anyone who has had an opportunity of enquiring into the subject must have been struck by the frequency with which errors have been made in the diagnosis of renal enlargements. When consisting of fluid accumulations, they have often been mistaken for ascites or for ovarian cysts, and have been operated upon as such by Meadows, Billroth, Goodell, Schelelig, Esmarch, Campbell, and others. As Dickinson remarks—"To suppose a solid renal tumour to be splenic, or a hollow one to be ovarian are errors of not infrequent occurrence; while a list of the enlargements which have either been erroneously supposed to be renal, or for which renal swellings have been mistaken, would be little short of a complete catalogue of abdominal tumours."

In order to save repetition when we come to discuss the diagnosis of individual diseases, it may be well now to consider the general characters of renal swellings as distinguished from morbid formations in other organs. It is not possible for one with so limited experience as I have had to make any general statements on the subject we are now considering, from personal observation, but from what I have been able to learn from the observations of others I may now briefly indicate to you the leading points by which increase in bulk of the kidney is to be recognised.

When considering malpositions of the kidney, occasion was taken to remark upon the anatomical relationships of the organs. It is not necessary now to repeat what I then said. The kidney being placed posterior to the peritoneum, when enlargement occurs the serous membrane is dissected from its posterior attachment, and the abdominal contents, being least resistant, are pressed forwards; while the firm structures posterior to the kidney seldom yield so as to cause more than an indistinct fulness in the loin. Therefore, while the enlarged kidney is in close contact with the posterior abdominal wall, it is separated from the anterior by the abdominal contents. The colon is situated to the front and on the inner side, unless the enlargement is extreme, so as, by dissecting the peritoneum from the anterior abdominal wall, to bring the kidney into contact with it. The small intestine is also in front of the renal swelling, and on percussion the renal dulness is found to be continuous with that of the spine. It may be inferred from what I have just said that these relationships always exist, but although this is the almost universal rule, there are a few exceptions, which, however, it is not necessary to consider at present.

The swelling is usually rounded in all its margins, and its inner border is lost against the spine. When small it is confined to one side of the abdomen, but if greatly enlarged, although in the first instance its increase is only noticed between the ribs and the crest of the ileum, the growth may cross the middle line, and occupy a considerable part of the opposite side of the abdomen. As may be supposed, the signs of displacement of neighbouring organs will slightly vary according as the disease involves one or other part of the kidney, and also they will depend upon whether or not adhesions have been formed. Sometimes percussion fails to betray the presence of bowel in front of the swelling on account of the intestinal gas having been expelled by pressure; usually in these circumstances careful palpation succeeds in revealing the empty intestine between the renal swelling and the anterior abdominal wall.

Whether or not the enlarged kidney follows the respiratory movements depends upon the adhesions the organ has formed with surrounding parts. In some instances contraction of the diaphragm may communicate movement to the swelling, but as a rule the kidney is immobile both during deep respiration and on palpation. A few cases, as will be seen from my statistics, have been recorded of movable cancerous or hydronephrosed kidney.

The most important diseases which require to be distinguished from enlargements of renal origin are ovarian and omental tumours, enlargement of the spleen, tumours of the liver, intestinal accumulations, perityphlitic abscess, and ascites, also malignant disease of colon.

It is in connection with fluid accumulations that most difficulty has arisen. Hydatid cysts, cysts of the liver and spleen, ovarian cysts, ascites, and perinephritic abscess have been mistaken for renal lesions. The history of the case, as showing the direction of growth, and the relationship of the swelling to the bowel, when considered along with the accompanying symptoms, usually clear up the diagnosis.

In ovarian cysts both loins are resonant, the intestine being almost invariably behind. The bowel is pushed aside so that the growth is in direct contact with the anterior abdominal wall, and is frequently bound to it by adhesions. In a few exceptional cases, however, intestine has been found fixed to the anterior surface of an ovarian cyst, and, on the other hand, occasionally in very large renal accumulations, the intestine gets behind the bulk of the fluid: consequently the presence of bowel in front does not preclude the possibility of ovarian cyst, nor its absence that of a renal swelling. Excepting these rare cases, the position the bowel occupies in relation to the swelling is the most reliable guide in diagnosis.

In renal lesions the seat of the disease is generally indicated by some urinary disturbance, and in ovarian disease the diagnosis is assisted by the presence of some catamenial pain or disturbance. In renal disease vaginal and rectal examination seldom reveal any change further than depression of the uterus, whereas in ovarian disease the uterus is raised and frequently fixed, and the tumour can be felt in the pelvis. Tumours of the ovary usually make their appearance in the lower part of the abdomen, *a little* to one side of the middle line, but when increased in bulk they may occupy the whole of the anterior portion of the abdomen. They are, as a rule, movable, and frequently multilocular, in these respects differing from the large renal accumulations of fluid, which are fixed and unilocular.

Ascites, unless when it is limited, may be easily diagnosed from renal swelling. When general, the swelling is symmetrical, and the percussion in *both* flanks dull—the distribution of dulness varies with position—characters which distinguish a collection of serous fluid within the peritoneum from an accumulation of pus or urine in the kidney. Supposing, however, the ascites is limited (as it was in a patient whose autopsy I made a few days ago), the signs mentioned may not be present, and there may be considerable difficulty in distinguishing by a physical examination the two conditions. But while in the case referred to, the signs during life were equivocal, the concomitant symptoms clearly indicated the nature of the disease.

Perinephritic abscess is not apt to be mistaken for organic disease of the kidney unless the two conditions co-exist. Abscess external to the kidney causes a more diffuse swelling, and more lumbar bulging than renal growths; and fluctuation is more superficial. The local surface temperature is raised, and superficial œdema is more marked in the former than in the latter.

In hepatic cysts and solid tumours of the liver, the new formation lies in contact with the abdominal wall, very rarely is bowel interposed; consequently the liver and the tumour dulness are continuous. These growths increase in size from above downwards, and are nearly always associated with symptoms of hepatic disturbance. Cysts arising from the posterior margin, or the concavity of the liver may be very difficult of diagnosis.

Splenic growths are easily distinguished from renal by the fact that the intestine is not in front of them, and generally the sharp and well defined edge, and the notch of the spleen can be felt. The splenic growth is recognised by being movable, especially upwards; by having, unless the organ is greatly enlarged, an area of clear percussion between it and the spine; by seldom causing pressure upon veins, and producing varicocele; by the other symptoms that accompany splenic enlargements—for example, leukæmia, amyloid disease, anæmia, &c.

Tumours or abscess connected with the lumbar or mesenteric lymphatic glands are sometimes very difficult to define. They are, however, usually symmetrical, are not complicated by urinary disturbance, but are associated with symptoms of intestinal disease, with glandular enlargements elsewhere, or evidence of tubercular disease in other organs.

Fæcal accumulations, fæcal and perityphlitic abscess, are not likely to be mistaken for renal swelling if the symptoms are carefully considered along with the physical signs.

The only point to which I have still to ask your attention is the character of the fluid contents in the various accumulations likely to be confused with renal growths. The absence of albumen in considerable amount (below 2 per cent) and the presence of urea is in favour of a renal disease, and against ovarian cyst and ascites. I remember, however, examining some ascitic fluid, removed by Professor George Buchanan, while I was his assistant in the Western Infirmary, which contained only a small quantity of albumen and a very distinct amount of urea. On the other hand, it is not uncommon to find the fluid from a hydronephrosis, or from cystic disease, contain along with a quantity of urea, a measurable amount of albumen. I cannot here enter into full details regarding the character of the various fluids which may be removed by tapping for diagnostic purposes; their general peculiarities, however, may be briefly indicated.

In simple ascites the fluid is usually clear, sp. gr. 1010 to 1015, *and highly* albuminous; it does not usually contain urea unless the effusion is the consequence of, or associated with Bright's disease. In hydronephrosis, on the other hand, the fluid, although clear and of low specific gravity, never contains a large amount of albumen, and usually urea is found in it. In fluid from hydatid cysts echinococci or hooklets are generally discovered on microscopic examination; the fluid, unless contaminated with blood or pus, is clear, of low specific gravity (1005 to 1010) and contains a large percentage of chloride of sodium, but no urea or albumen. In ovarian cysts the fluid is generally dark, ropy or even gelatinous in consistency, and of high specific gravity, but sometimes it may more closely resemble that of ascitic dropsy. The fluid from parovarian cysts is more likely to be confused with that from renal accumulations, being clear, of low specific gravity, and slightly albuminous. Of the large number of specimens of parovarian fluid which I have examined chemically in none have I found even a trace of urea. Beyond the detection of echinococci, hooklets, or tube-casts, little is to be derived from microscopic examination of these fluids. Cellular structures such as pus, blood, single epithelial cells, Drysdale's corpuscles, do not, taken *per se*, guide one to the situation of the lesion, but when taken along with the other facts of the case, the significance of these elements may be considerable.

LECTURE III.

Diseases characterised by accumulations of non-inflammatory fluid—(1) *Congenital Hydronephrosis, with illustrative cases.* (2) *Acquired Hydronephrosis: enquiry into etiology and morbid anatomy, with statistics, illustrative cases, and preparations; consideration of circumstances determining degree of distention and atrophy of renal tissue; physical signs, symptoms, diagnosis, and prognosis.* (3) *Three varieties of cysts*—(a) *Simple cysts and cystic degeneration,* (b) *Hydatid cysts,* (c) *Congenital cysts—considered in respect to etiology, morbid anatomy, symptoms, and diagnosis, illustrated by specimens and cases. Treatment of Hydronephrosis by therapeutic agents, manipulation, tapping, aspiration, nephrotomy, and nephrectomy. Tables of operations. Treatment of cystic disease.*

GENTLEMEN,—We now come to consider those diseases of the kidney associated with the accumulation of fluid in the pelvis, in the substance, or at the surface of the kidney. The fluid which so congregates may be either inflammatory or non-inflammatory. It will be most convenient in the first instance to discuss the diseases characterised by an accumulation of non-inflammatory exudation, and in this class the following conditions may be included:—Hydronephrosis, and cysts in the substance and on the surface of the kidney.

When the cavity of the pelvis is distended by serous fluid, the condition is described as hydronephrosis. This affection was recognised by the early observers, but the term just employed was first applied to the malady by Rayer. Comparatively little practical importance was attached to this condition until it was embraced within the domain of operative surgery, and till frequent mistakes had been made in diagnosis, the distended kidney having been confounded with ovarian cysts. When the question of operative interference presented itself, it came to be discussed how far it was possible to diagnose renal from ovarian and ascitic accumulations.

Hydronephrosis may be congenital or acquired, may exist on one or both sides, and may be permanent or transitory.

Congenital hydronephrosis arises from various causes, such as partial occlusion of the ureter by a valve, compression from without, the presence of a tumour within the ureter, torsion of the ureter around the renal artery or on its own axis, as observed in displaced kidney, enlargement of the prostate, constriction of the lower urinary tract, &c.

Two specimens will be sufficient to illustrate this variety of hydronephrosis. The first specimen, removed from the body of a still-born child, is an interesting and unique one. The urinary bladder has been opened and everted so as to show a cyst about the size of a walnut, which has almost completely occluded the orifice of the right ureter, and caused enormous distention of the renal pelvis, so that the hydronephrosis, with the remaining renal substance, is about twice the size of a normal adult kidney. The second preparation differs from the one just described in being one of double hydronephrosis. It was removed from the body of a child who died at the age of four months. The ureters are each about seven inches long, and have become so dilated that their lumen easily admits the little finger. This dilated condition exists from the bladder upwards, and is associated with a corresponding distension of both pelves. The constriction is in the wall of the bladder, which is greatly thickened.

Although of considerable pathological interest, cases of congenital hydronephrosis are not of much practical importance, and seldom call for surgical interference. Thornton, however, successfully operated upon a child, aged 7 years, who had hydronephrosis from occlusion of the ureter.

The causes of acquired hydronephrosis are exceedingly various, so that, practically, it is impossible to give anything like a complete enumeration of them. For the purpose of satisfying myself in regard to the question of etiology, I have collected statistics from such sources as published cases, hospital reports, museum catalogues, and records of autopsies, and find that these give very different results. The reason of this appears to be that in many instances the hydronephrosis is a lesion of only secondary importance. For example, in cases of malignant tumour of the pelvic organs, the patient may die without the question of the existence of a hydronephrosis having been raised, and the distention of the ureters and pelves of the kidneys is observed, and recorded in the *post-mortem* journal, but no further interest is taken in it, the attention being concentrated on the graver malady.

It is commonly stated in books that hydronephrosis is usually confined to one side. If we take published cases alone, or if we take cases which have called for operation, I willingly admit the truth of that statement; but if we include in our statistics all cases, wherever they may be found, the statement is incorrect and misleading.

In presenting to you the results of my enquiry into the etiology of hydronephrosis, based upon an analysis of 665 cases, it is right to state that I have eliminated as far as possible all instances where it might be supposed that the serous accumulation had been contaminated by pus. It is not, however, always practicable to differentiate pyonephrosis from hydronephrosis, these two conditions being, in many instances, different phases of the same malady. The necessity, however, for making the limitation just indicated is exemplified by lesions secondary to renal calculus. On consulting the literature of the subject, it will be found that calculus in the kidney or ureter is very frequently named as a cause of hydronephrosis, whereas, as a matter of fact, in nearly all instances where calculus exists more or less suppuration is induced.

In the discussion of this subject, I shall endeavour to illustrate by museum specimens, the principal lesions leading to dilatation of the upper urinary tract from backward fluid pressure.

The specimen which I now show you is one I removed a few days ago from a woman who died of acute pneumonia. At the autopsy a lesion was detected belonging to the first section in my classification of causes—namely, *simple or malignant tumours of the pelvic organs causing pressure on the ureters.* In this section I have been able to discover 143 instances of double, and 41 of single hydronephrosis. This individual example is a myoma involving principally the posterior wall of the uterus. The uterus was firmly bound down by old inflammatory adhesions, so that the growth, by its increase in bulk, gradually compressed both ureters. During life the condition of the kidneys was not known, but after death both ureters were found to be distended down to within two inches of the bladder, to such an extent as to admit the little finger with ease. The pelvis of the right kidney was capable of containing 5, that of the left kidney 6½ ounces of fluid. In both organs, however, a considerable amount of secreting tissue remained.

Tumours of the pelvic organs—for example, cancer of the uterus, vagina, bladder, or rectum—although a very frequent cause of hydronephrosis, rarely lead to sufficient distention to produce a palpable abdominal tumour. The impermeability of the ureters in cancer of the pelvic organs is rarely due to the tubes themselves becoming involved. It arises either from the posterior wall of the bladder becoming infiltrated, or from thickening of the pelvic cellular tissue. The growth of the malignant disease is usually rapid, and in most instances involves both ureters, consequently extreme expansion of the tubes is not so often observed in this as in more chronic conditions.

In the second series I have placed together such lesions as *stricture of the urethra, enlargement of the prostate, hypertrophy and cicatrices of the bladder.* In this class are included 195 instances of double, and 39 of single hydronephrosis.

You have placed before you ten specimens illustrative of this class. Stricture of the urethra may lead to distention of the ureters in one of two ways, either by its direct impediment to the expulsion of urine, or by inducing hypertrophy of the muscular coat of the bladder. It will be observed that the large majority of the cases are bilateral, and in most the hydronephrosis was not extreme.

The next class includes *tumours and abscesses of the pelvic organs leading to torsion and subsequent distention of the ureters.* In this class we have 23 cases of double, and 9 of single hydronephrosis.

Twenty-four cases were also caused by *tumours or abscesses of the abdominal organs.* Of these, 7 were single, the remainder double.

This specimen which I hold in my hand illustrates very well the condition we are now considering. The prostate gland, as you will observe, is increased in bulk, and is occupied by a considerable abscess, which has displaced the ureters outwards, caused a sudden curve in their course, and thereby led to dilatation of the tubes and pelves.

Displacement of the pelvic organs is, in the female, a frequent source of hydronephrosis. Under this head may be classed compression by retroflexion of the pregnant as well as of the non-pregnant uterus. The ureters descend to the bladder alongside the portio vaginalis of the uterus; hence, if the uterus becomes bent upon itself, the ureters likewise become distorted, and hinder the passage of fluid to the bladder. In speaking of the pathology of movable kidney, I illustrated to you how prolapse of the bladder or of the uterus might lead to transitory hydronephrosis. Under this head are placed 23 double and 20 single cases.

Bands and adhesions, in a few rare instances, have led to compression of the ureter upon one or upon both sides—5 of the former and 7 of the latter. Dr. Simpson recorded in the *Glasgow Medical Journal* a case in which the right kidney was converted into a cyst of considerable size by a fibrous band stretching from the brim of the pelvis to the promontory of the sacrum, and compressing the ureter on the right side. Such bands are usually a consequence of chronic inflammation.

Renal calculus, either in the kidney or in the ureter, has been stated to be a frequent cause, especially of unilateral obstruction. For example, in 32 cases recorded by Dr. Roberts, impacted calculus was found to be the obstruction in 11; and Dickinson states that in 17 cases out of 42 the obstruction was of this nature. This specimen, from the Museum of the Western Infirmary, illustrates beautifully the mode of obstruction. About 1½ inches above the bladder the right ureter is obstructed by an oval calculus; above the impaction the ureter is considerably distended, while below the calculus it is much contracted.

The kidney on the affected side is converted into a cyst, and no proper renal tissue remains.

On entering upon this enquiry into the etiology of hydronephrosis, I was prepared to find impaction of calculus to be, of all others, the most frequent cause of hydronephrosis; but, by carefully eliminating all instances where suppuration was induced by the stone, I find only 51 cases of single and 17 of double hydronephrosis with this origin.

Displacements of the kidney causing sudden bends, torsions, or obliquities of the ureter, have already been fully discussed as causes of transitory or permanent hydronephrosis in cases of movable kidney. Extreme hydronephrosis may result from the ureter entering the pelvis at an acute angle, even when the kidneys are not movable. The two specimens I now present to you from the Museum of the Western Infirmary are of considerable interest; one was removed from the body of a patient who was under the care of Dr. James Finlayson, the other from a patient who died in Professor George Buchanan's wards. The following is the description of the specimens as given by Dr. Joseph Coats in the Museum Catalogue:—

In the first mentioned specimen "the external outline of the kidney is greatly enlarged, the organ measuring 6½ inches from above downwards. As shown in the preparation the pelvis is greatly dilated, measuring 3½ inches from above downwards, and 2½ inches transversely. It communicates with a series of large compartments which represent greatly dilated calyces, and which, in some places, extend close to the surface, the remaining kidney tissue forming simply a thin rind. The ureter is not dilated, and it enters the pelvis at an acute angle about ¾ inch above the lower extremity of the latter. The pelvis is not elongated towards the ureter, and the orifice, into which a piece of whale-bone has been passed, is even smaller than normal. From the position of the ureter the orifice would be valved when the pelvis was full.

"The other kidney was considerably enlarged, weighing 8½ oz.; but otherwise normal (*compensatory hypertrophy*). The patient, a man aged 53, was affected with symptoms of acute rheumatism and pneumonia with pleurisy. There is no note of renal symptoms during life."

In the second specimen "the preparation shows a very large cyst which contained 46 oz. of fluid, and represents greatly dilated pelvis of kidney. This cyst is attached to the lower and anterior aspects of the kidney, the vessels passing to the organ running along its upper border. Towards the kidney there are 6 large rounded apertures, which represent calyces much less dilated than the pelvis, and these apertures communicate with cavities inside the kidney. The uppermost of these cavities is of considerable dimensions, but in the case of all of them there is a considerable amount of kidney substance between them and the surface.

"The ureter, into which a probe has been passed, is found to enter the dilated pelvis near its inferior part at an acute angle, traversing the wall of the cyst for some distance and opening by a slit-like aperture. The ureter is not dilated, and its aperture is not unduly narrow. The other kidney was normal in size, weighing 6 oz. This is noteworthy in connection with the fact that in the affected kidney there was still a considerable amount of kidney tissue remaining, as mentioned above. Nothing was known during life of the existence of this condition."

Whereas most modern pathologists regard the angular insertion and the valvular closure of the ureter to be the cause of hydronephrosis in such cases, Simon and a few

Continental writers, on the other hand, hold the opinion that the collection of fluid within the renal pelvis is the cause of the alteration in the relationship of the kidney and its duct. The latter assume that, a temporary impediment having caused a hydronephrosis, the kidney becomes displaced, and at the same time the lower half of the distended renal pelvis compresses the first part of the ureter; or if the pelvis be dilated more on one side of the point of origin of the duct than the other, the ureter is contorted, and a valvular obstruction created which becomes permanent. As the accumulation increases the kidney becomes pushed outwards and backwards, while the upper portion of the ureter comes to be situated anteriorly. Another explanation has been offered by Landau, who holds that the frequently repeated displacements, twistings, and kinkings of the ureter in movable kidney are calculated to produce urinary obstruction and hydronephrosis. He maintains that "this view is confirmed by the fact that the majority of hydronephroses of obscure origin are seen in women of considerable age, and on the right side." This question I have already fully discussed in last lecture.

If the edge of the bony pelvis is unusually sharp, the ureter may turn over it more abruptly than usual, and be obstructed. This class accounts for six double and five single hydronephroses.

Tubercular disease of the bladder is not a very common cause of hydronephrosis. I have only been able to find 13 instances of bilateral and 17 of unilateral obstruction as a consequence of this disease. This preparation from the Museum of the Royal Infirmary illustrates this class, and is one of great interest.

The patient was a boy, aged seven years, who was admitted with uræmic symptoms—namely, unconsciousness, inarticulate cries, laboured respiration, jactitation, dilated but sensitive pupils, and tremors. Latterly there were convulsions, with paralysis of left arm and leg, unconscious defæcation, &c. The patient died the day after admission, and there was no distinct history obtainable, but he seems to have been ill for about six weeks.

The preparation of the bladder shows that its mucous membrane is occupied by several ulcers. The largest of these is at the orifice of the left ureter, and measures about 2 inches in diameter. There is a smaller one at the orifice of the right ureter, and two others higher up than these. All the ulcers are flat and superficial, and their floor is occupied by minute white tubercles. In addition, it was found that the left kidney and ureter (which are not preserved) presented disease of a similar nature. The kidney was enlarged and converted into a series of cavities containing a pultaceous material. The walls of these cavities, as well as the pelvis and ureter, were thickened and their surface irregular. The ureter, a portion of which is preserved attached to the bladder, was much thickened, but its cavity was very small, being almost obliterated by pultaceous material.

The right kidney, as seen in the preparation, presented a pretty advanced stage of hydronephrosis. The ureter was also much distended, and, as shown, remarkably bent on itself, while the distention occupied its entire length down to the bladder. Just at the bladder it is narrowed, and it was found that, "though elsewhere it contains clear fluid, and its walls are normal in structure, yet here the calibre is obstructed with pultaceous material, and the mucous membrane of the tube presents the same appearances of tubercular ulceration as the mucous membrane of the bladder. The pultaceous matter has produced complete obstruction, so that before opening the ureter it was found impossible to press its contents into the bladder." In the preparation a piece of whalebone has been forced through the obstructed orifice of the ureter.

The probable course of the disease in this case seems to have been—first, local tuberculosis of the left kidney, extending down the ureter to the bladder; then ulceration of the bladder, beginning to spread into the right ureter. The secretion of the ulcer has obstructed this ureter, and led to its distention and the consequent hydronephrosis. The case was under the late Dr. Steven in Ward V.

An almost exactly similar case will be found in the Museum of the Western Infirmary.

Another cause of *obstruction* to the outflow of urine *from* the ureter is *tumour of the bladder*. I have already shown you a specimen in which a cyst at the orifice of the ureter caused a congenital hydronephrosis. Silbermann mentions an instance in which a fibroma of the bladder obstructed the vesical orifice of the right ureter, and here you have a preparation illustrating how a villous cancer of the posterior wall of the bladder may cause hydronephrosis. You see that the urinary bladder is occupied, chiefly on its posterior wall, by a bulky tumour, having a very irregular surface, at parts shreddy. The tumour is mostly on the left side of the bladder, more behind than in front. The left ureter is covered, and the tumour just reaches the orifice of the right ureter, a small projection from it almost covering the orifice. Both ureters were much distended, thinned, and tortuous, and the left kidney was in a state of hydronephrosis.

Tumours of the bladder do not cause obstruction to the flow of urine so frequently as might be supposed. I have been able to find only three cases in which they have caused double, and seven cases in which they caused single hydronephrosis.

I may now ask your attention to this table, by which you will see at a glance the general facts brought out by my enquiries.

TABLE SHOWING THE CAUSES OF ACQUIRED HYDRONEPHROSIS.

STATISTICS COLLECTED FROM PUBLISHED CASES, HOSPITAL REPORTS, MUSEUM CATALOGUES, AND RECORDS OF AUTOPSIES.

	Hydronephrosis.	
	Double.	Single.
Simple or malignant tumours of pelvic organs causing pressure on ureters, ...	143	41
Stricture of the urethra, enlarged prostate with hypertrophy of the bladder, ...	195	39
Tumours or abscesses of pelvic organs leading to torsion of the ureters, ...	23	9
Tumours or abscesses of abdominal organs, . . .	17	7
Displacement of pelvic organs, causing torsion of ureters, ...	23	20
Bands and adhesions, ...	7	5
Renal Calculi, ...	17	51
Displacements of the kidney, ...	1	16
Tubercular disease of the bladder, ...	13	17
Tumours of the bladder, ...	3	7
Ureter entering renal pelvis at acute angle, . . .	6	5
Total, 665.	448	217

Besides the causes of hydronephrosis included in this classification there are many others which occasionally lead to obstruction, such as injury, hydatids, enlargement of lymphatic glands, tumours of the bony pelvis, and frequent micturition in cases of irritable bladder.

Bardenheuer records a case of hydronephrosis the result of injury. The patient, a child, aged 5 years, was run over by the wheel of a carriage, which passed over the lumbar region, causing considerable tumefaction, and injury to the left ureter. The accident was followed by the formation of a smooth renal swelling, and on exploratory puncture clear fluid resembling urine was drawn off. Nephrotomy was performed three months after the accident, and the patient made a good recovery.

Some of the most marked instances of hydronephrosis have been those in which no cause of obstruction could be found after death. Such cases were known to ancient writers, but no explanation was offered. Cruveilhier believed that if the pelves or ureters were over distended, their elasticity was lost, so that even although the obstruction was removed the sac remained distended in spite of the patency of the ureter. Many of these obscure cases in which no organic or other stricture could be discovered after death have been accounted for by modern pathologists. Virchow, Simon, Cohnheim, Coats, and others have observed cases in which the ureter arose at an acute angle from the pelvis of the kidney, pervious, after death, but closed sufficiently during life to cause considerable distention. Most authors believe the angular insertion and valvular closure of the ureters to be the most likely cause of the unexplained cases of hydronephrosis of the older writers.

The proportion of cases of hydronephrosis in which a palpable abdominal swelling is discoverable during life is small in all cases, but especially so when the disease is bilateral. By the pathologist the lesser degrees of hydronephrosis are seen frequently, and to this condition some clinical observers would apply the term "dilatation," reserving the name "hydronephrosis" for those instances in which the distention of the pelvis is sufficient to be palpable during life. This seems to be a somewhat arbitrary distinction, seeing that whether or not the swelling is discoverable must depend upon a number of collateral circumstances, independent of its actual size.

We have now to enquire:—What circumstances determine the degree of hydronephrosis? The amount of distention is not always in a direct ratio to the amount of obstruction; on the one hand an apparently trivial obstruction may cause a considerable dilatation of the ureter and pelvis, whereas, complete obstruction of the tube may be associated with comparatively little hydronephrosis. Cases, however, have been recorded in which the ureter has been without exit from the first, and the child was born with a hydronephrosis.

In order to understand the pathology of hydronephrosis, it will be necessary to study the course of events when a ureter is partially obstructed as well as when it is completely occluded.

Take first an instance of incomplete or transitory obstruction, as found, for example, in cases of displaced kidney, where the ureter has an abnormal insertion into the renal pelvis, and the urine is only permitted to flow into the bladder when the pressure within the pelvis and ureter is sufficient to stretch or expand out the twisted part. When this relief occurs, the previously high pressure within the uriniferous tubules and Malpighian capsules is suddenly diminished, and the vessels of the glomeruli being relieved from external pressure, a considerable hyperæmia is induced, followed by rapid secretion of urine containing albumen. Supposing, however, instead of a sudden relief of the constriction there is stricture rather than transitory obstruction, and only leakage through the narrow passage is possible. In these circumstances the activity of the gland will be maintained with a constant and slightly varying pressure within its cavity. If this be long continued considerable hydronephrosis will result. There are therefore two conditions which cause considerable distention, partial obstruction of the ureter with leakage, and complete but transitory obliteration associated with repeated sudden collapses and dilatations of the upper urinary tract. Hence the lesions which cause advanced hydronephrosis are unilateral external pressure, obliquities of the ureter, valvular obstructions, cicatricial contraction, and impacted calculi which do not completely occlude the passage.

When the ureter is obliterated completely a different course of events follows. The following experiment, performed by me while conducting a series of investigations relating to the functions of the kidney, and communicated to the Royal Society of Edinburgh in 1878, may throw some light on this subject. The purpose of the experiment was to discover how far the rapidity of the circulation through the kidney depended upon the tension of fluid in the uriniferous tubules. The experiment was performed upon the kidney of a horse killed immediately before.

Salt solution was passed into the renal artery under a pressure of 50 mm. of mercury. At the same time the ureter was filled with salt solution and subjected to various pressures. In the first experiment, in which no pressure was applied to the fluid in the ureter, the amount of solution that passed out by the vein was 23·07 cc. per minute; whereas, when the pressure upon the fluid in the ureter equalled 45 mm. of mercury, only 1·5 cc. of the solution passed by the vein in the same time. The effect of the increased tension of the fluid in the ureter is shown in the following table:—

No. of Experiment.	Arterial or Afferent Pressure in mm.	Pressure in Ureter in mm.	Quantity of Fluid passed per Vein per Minute in cc.
1	50	..	23·07
2	50	10	15·3
3	50	20	10·3
4	50	30	3·33
5	50	40	2·3
6	50	45	1·5

When a dog was narcotised, and a cannula placed in the renal vein to intercept the blood flowing through it, the ureter was filled with water, and this water was alternately submitted to and relieved from the pressure of 35 mm. of mercury. Each time the ureter was distended the blood-current through the renal vein, at all times pretty rapid, became slackened, and was notably less rapid than when the pressure upon the side of the ureter was removed. The inferences to be drawn from these experiments are:—That when the tension of the fluid in the tubuli uriniferi increases, the amount of urine secreted diminishes, and when it becomes equal to the arterial tension the secretion ceases, and the circulation through the Malpighian body may be stopped altogether by collapse of the arterial coil when the pressure outside is greater than that inside the vessel. If this happens it can be easily seen how, by damming up of the urine, atrophy of the substance of the kidney may be produced as a result of insufficient blood supply, seeing that most of the cortex is nourished by the capillaries arising from the efferent vessels of the glomeruli.

Atrophy of one kidney when induced by sudden and complete obstruction to the ureter, is usually rapid, and is in most instances followed by a compensatory hypertrophy of the gland on the opposite side. The destruction of renal tissue is brought about in two ways:—(1) By the insufficient blood supply consequent upon the tension of the fluid in the capsule of the Malpighian body, and (2) by the pressure of the fluid within the pelvis causing dilatation. The pressure exerted by the urine, which accumulates behind the obstruction, leads to expansion of the calices, and flattening of the papillæ. Gradually as the hydronephrosis advances the pyramidal portion becomes excavated, until, as seen in extreme cases, the whole organ is replaced by a cyst, or by a series of cysts, separated from one another by septa of fibrous tissue. As the pelvic cavity and the capsule approach one another the renal form of the organ is rapidly lost. The outer surface may become rough, irregular, and lobulated, the depressions between the lobules corresponding to the connective tissue septa within the sac, which indicate the remnants of the calices of the kidney. These pouches communicate freely with one another, and in most instances, with the dilated pelvis, but in a few rare cases the sacs may be shut off from the pelvis by fibrous tissue. As you will observe in this specimen the thickness of the wall varies considerably in different parts, and if examined microscopically, it will be found to be composed of dense fibrous tissue, without any histological resemblance to normal renal structure. In some cases, as in the one I now show you, the kidney may not be much augmented, even although its cavity has been increased in capacity. On the other hand, in the higher grades of hydronephrosis the kidney may be represented by an enormous membranous sac, which can only be recognised as renal in its origin on account of its relations to the ureter and the colon. To the latter it is frequently adherent, but it may also be bound to other neighbouring organs such as the spleen, liver, pancreas, or it may be united to the peritoneum, omentum, or mesentery.

The fluid contained within the hydronephrosis varies according to circumstances. When bilateral or transitory, its fluid contents resemble urine, but differ from that excretion in degree of concentration. As pointed out by Dickinson:—"It is sufficiently obvious that when the hydronephrosis depends upon stoppage below the bladder, as in most cases of congenital origin, the collected fluid is necessarily urinous, since it contains the whole renal secretion." You may ask the question, Why is the fluid not simply urine? If you recall to mind the process by which urine is excreted you will have an explanation. The separation of urine is by a process of filtration under pressure, the tension of the blood in the glomerulus being greater than that in the Malpighian capsule. I demonstrated, in a paper published in the *Journal of Anatomy and Physiology* (vol. xii), that when a fluid, such as blood, containing crystalloids and albumen, was filtered under pressure through an animal membrane, the greater the pressure the closer the relationship between the filtrate and the original solution. Now let us apply this physical fact to the question under discussion. The difference between the pressure in the glomerulus and that in the capsule of the Malpighian body may be diminished either by a loss in the arterial tension or by an increase in the tension of the urine within the uriniferous tubules. In hydronephrosis the latter condition exists; consequently, we have a secretion of a fluid of low specific gravity. When speaking of transitory hydronephrosis, as met with in movable kidney, I showed you, by reference to a case that simultaneously with the reduction of the obstruction, and diminution in the size of the distended pelvis, there was a flow of a small quantity of concentrated urine followed by a copious excretion of urine of low specific gravity.

Transitory hydronephrosis occurs in cases where the obstruction is only occasionally present. A patient consulted me a few weeks ago, and on questioning him I found that he suffered from frequent attacks of protracted, but not very severe renal colic. During several of these attacks I detected considerable increase in the bulk of the left kidney. The pain usually lasted for 48 or 56 hours, and recurred at intervals of from four to seven weeks. When it passed off the swelling also diminished in bulk, and this was followed by a flow of concentrated urine. There being no deposit or abnormal constituent in the urine at any time, and nothing in the symptoms to indicate the precise cause of the retention of urine within the left ureter, I am at present unable to explain the case otherwise than by supposing that the ureter is inserted into the kidney at an acute angle, and is therefore easily obstructed by backward fluid pressure, which causes distention of the pelvis. The attacks are usually brought on by the patient allowing his bladder to become over distended.

I consider that a clear distinction should be drawn between cases, such as the one I have just narrated; cases in which the pelvis is generally undistended, and hydronephrosis only occurs when the ureter is obstructed; and those instances in which a persistent swelling becomes temporarily relieved by a urinary discharge. To the former, the terms transitory, intermittent, or relapsing hydronephrosis should be limited. In this restricted sense intermittent hydronephrosis has been seldom observed. This may be due to the circumstance that the sac is seldom large in size; and the symptoms, although they may be acute, are soon relieved by evacuation. Temporary subsidence of the swelling is an important characteristic of, and frequently observed fact in renal accumulations; and if associated with the discharge of an increased quantity of fluid from the bladder, is of great diagnostic value.

When the disease affects one kidney only, atrophy of the renal tissue advances to a degree which would be inconsistent with life were both kidneys affected. In extreme cases the fluid is of low specific gravity, often colourless, but may be clear yellow, turbid straw coloured, or reddish; its reaction is usually faintly alkaline, and it may contain neither urinary constituents nor albumen, but consist simply of a saline solution with more or less altered epithelial elements in suspension. In some instances the fluid is ammoniacal, and it often contains one or more of the normal ingredients of urine; oxalate of lime, urates of soda or ammonia, or uric acid have been found in the fluid; or the contents of the sac may consist of thick fluid holding in suspension fatty matter or cholesterine.

The size of the hydronephrosis varies greatly. Sometimes it only amounts to a slight distention of the renal pelvis, while in other instances it attains formidable dimensions. It may occupy the whole of one side of the abdomen, press the other organs to the opposite side, and form adhesions to them. Cases have been recorded in which the sac contained as much as 25 and 30 gallons. In the *Philosophical Transactions* for 1746, Mr. Glass reported a case of hydronephrosis in which the cyst contained 30 gallons of light brown fluid. The circumference of the abdomen was 6 feet 4 inches; and the measurement from the ensiform cartilage to the pubes was 4 feet and ½ an inch. On glancing at the table of operations, it will be noticed that in many of the earlier cases the diagnosis was ovarian cyst, and in some of these the accumulation of fluid was very considerable.

The *physical signs* and symptoms of hydronephrosis may be now considered.

When the swelling has attained any considerable size, it can be felt on palpation to be situated in the flank, and it may cause a bulging in that situation. It increases in size from behind forwards, enlarges towards the umbilicus, and may cross the middle line, but lies outside and posterior to the colon. Sometimes the swelling can be felt to be irregular, and in many instances fluctuation can be detected. Dulness is most distinct posteriorly between the ribs and crest of the ileum, and extends forwards till the tympanitic note of the colon is reached. The colon does not always lie upon the hydronephrotic sac; but when the disease affects the right side, the great bowel lies to the inner side; in hydronephrosis of the left kidney the colon may either pass in front of the sac, or may be pressed to one side along with the coils of the small intestine. The extent of the dull area will depend upon the contents of the colon, and as constipation is a frequent result of the pressure, care must be taken to empty the colon of solid or fluid matter. Injection of air by the anus may assist in determining the exact relation of parts. When the distention is slight, and not accompanied by much suffering, the surgeon's attention is seldom directed to it; his services are first called for when the swelling becomes large, and contains many pints or even gallons of fluid.

In the etiological statistics which I have collected, I was unable to gain any reliable information regarding the proportion of cases in which the hydronephrosis was sufficient to give rise to a palpable abdominal swelling. Roberts states that out of forty-two cases of acquired hydronephrosis, in which the changes in the kidney were well marked, the swelling was palpable in twenty-five. And Dickinson says:—"I estimate that, in about one-fourth of the cases of single hydronephrosis, the swelling, as observed during life, has ceased to be limited to the lateral half of the body, while, in perhaps a third of these, it has come to occupy the greater part of the belly. When the cyst has transgressed the limits characteristic of renal tumours, the dilatation has become great, the walls attenuated, and the fluidity of the contents obvious."

The *symptoms* of hydronephrosis depend upon whether the disease is double, single, or transitory—we will leave congenital cases at present out of account. When the lesion is bilateral and complete—as from impaction of calculi in both ureters, or obstruction from other causes, the patient dies within a limited period from uræmia; whereas, in the slighter degrees of double hydronephrosis in which the impediment to the flow of urine is but slight; during life there may be no symptoms, and, as a rule, the hydronephrosis does not attain any great size. But while in some cases hydronephrosis may exist without provoking symptoms, in many recorded instances the patient complained of pain in the lumbar region, frequent and uneasy micturition, associated with occasional suppression, followed by sudden relief, and an increase in the flow of urine. In others, again, evidences of incomplete elimination showed themselves by vomiting, elevated temperature, convulsions, and, if the obstruction was not relieved, death occurred by coma.

If one ureter only is impermeable, the healthy kidney undergoes compensatory hypertrophy, so that a single hydronephrosis may attain a considerable size without provoking other than local symptoms, such as pain in the back, swelling, and constipation from pressure on the colon. When, however, the sac enlarges suddenly from obstruction, acute symptoms may attract the attention of the medical attendant to the condition of the kidney. These symptoms closely resemble those of obstruction of the ureter from calculus, and the diagnosis of the cause of obstruction cannot be settled in many instances until some time has passed. The urine may be scanty and tinged with blood, and the patient may suffer from severe paroxysms of pain; the most important fact to observe is the character of the renal sac, and the quantity of urine passed from time to time. If the dilatation of the pelvis varies, and is associated with a corresponding increase and diminution in the quantity of urine, without pyuria, the evidence is strongly in favour of a hydronephrosis.

In discussing general symptomatology I dealt fully with the diagnosis of fluid distentions of the kidney, as distinguished from ovarian and omental tumours, enlargements of the spleen, tumours of the liver and colon, intestinal accumulations, perinephritic abscess, and ascites, and I also showed you the diagnostic value of a careful examination of the fluid withdrawn from the various accumulations, so that it is not necessary now to repeat what was then said.

I may, however, state very briefly the differential *diagnosis* between hydronephrosis and the two diseases most liable to be mistaken for it—namely, cancer of the kidney, and cystic degeneration. When the hydronephrosis is unilateral, the swelling in the loin is large in size, but if the lesion occupies both sides the amount of swelling is never great. The swelling is fluctuant, does not preserve the shape of the kidney, is slow in development and generally painless, unless when greatly distended, is not attended by dropsy, hæmaturia, or cachexia, and may vary in size from time to time, any considerable diminution in bulk being associated with a sudden increase in the flow of urine. In cystic degeneration the growth is bilateral, non-fluctuant, preserves the shape of the kidney, slowly increases in size, is painless, sometimes attended by dropsy, and occasional moderate hæmaturia, and the swelling does not alter in size from time to time. In cancer, the tumour is limited to one side and may be of considerable size, it is non-fluctuant, irregular in form, rapid in growth, is associated with severe and almost constant pain, is characterised by copious and frequently recurring hæmaturia, and, during the later stages of the disease, by well marked cachexia.

When the fact has been determined that hydronephrosis is the lesion with which we have to deal, another important circumstance has still to be made out—namely, what is the cause of the obstruction of the ureter and the consequent accumulation of fluid. In the table showing the causes of acquired hydronephrosis (page 114), are stated many conditions which are easy of diagnosis, while in others, previous to operating, it is impossible to ascertain the nature of the lesion. For example, in most cases it is not difficult to discover the existence of a malignant or simple tumour of the pelvic organs, stricture of the urethra, or enlarged prostate, to which the presence of the hydronephrosis may reasonably be assigned. But it is not so simple to detect whether or not the obstruction is due to a torsion of the ureter, or to its compression by a band of fibrous tissue, or by an inflammatory adhesion. It is, in fact, the lesions which cause advanced hydronephrosis by unilateral obstruction which are difficult to diagnose, and it is in those very cases that surgical interference is likely to be called for.

The *prognosis* depends upon the cause of the hydronephrosis, and when it commenced to operate. In congenital cases, if the sac be large, death usually takes place at birth, and, if the child succeeds in entering the world alive, life is seldom prolonged beyond a few months or years. The duration of life, in acquired cases, depends upon whether the disease is bilateral, or affects only one side. In the former, if the obstruction be complete or nearly so, the patient dies within a limited period, but if the degree of hydronephrosis be slight, the course of the disease is very variable. In many instances, on account of the insidious onset and progress of the disease, it is very difficult even approximately to measure the duration. One circumstance which must, however, always be remembered by the surgeon, is the risk incurred in performing operations upon the lower urinary tract in such cases, on account of the danger of septic infection spreading from the bladder to the kidneys, and inducing thereby a suppurative pyelonephritis.

Although the terminations of hydronephrosis are seldom altogether favourable, yet the renal disease of itself seldom causes death. Most patients die from independent causes, which are in themselves irreparable. In a few examples in which the hydronephrosis is due to a temporary obstruction the cyst may spontaneously disappear; this most frequently happens when the accumulation is the result of renal calculus, or of uterine displacement. When the calculus is dislodged, or the uterine displacement relieved, the contents of the sac escape, and may not re-accumulate; but even although the hydronephrosis disappears, it cannot be expected that the atrophied renal tissue will recover its functions. While this is so, it must be remembered that during the time the one kidney has been inactive, the other has been undergoing a compensatory hypertrophy, so as to take up the function of both.

Death, however, may occur as a direct consequence of the hydronephrosis, independently of the fundamental disease. For example, the sac may rupture into the abdomen, either spontaneously or as a result of injury, or from its size it may interfere with the function of other organs. While, on the other hand, the lesion may involve both kidneys, and the patient may die from suppression of urine.

I will postpone the question of treatment till the end of this lecture, when I will discuss it along with that of cystic disease of the kidney.

Up to the present we have been occupied in the consideration of dilatation of the ureters, and of the pelves of the kidneys by non-inflammatory fluid, together with the disappearance of renal tissue resulting therefrom. This cystiform dilatation of the upper urinary tract is to be distinguished from those lesions in which cavities containing fluid are formed within the substance of the kidney itself.

The study of these diseased conditions naturally follows that of hydronephrosis. Most authors, however, include cystic disease amongst tumours, the principal reason for this being the increase in the size of the kidney associated therewith, but, when we consider the more minute changes, it will be seen that in retention-cysts the kidney dilates and becomes occupied by numerous excavations bounded by a fibrous tissue envelope, and that the process is due to a retrogressive or destructive rather than a formative or constructive disturbance of nutrition, such as is seen in neoplasms properly so called.

Cysts of the kidney may be divided into three classes—first, simple cysts and cystic disintegration; second, those due to the presence of parasites; and, third, those which may be included under the term congenital cysts.

You have already been shown how obstruction of the ureter leads to distention of the renal pelvis. When the tubuli uriniferi are closed by deposits or tube casts, or occluded by the contraction of connective tissue, the same kind of change results. The secretion accumulates behind the obstruction and distends the capsule of the Malpighian bodies or the lumen of the tubules into cysts filled by altered secretion.

These simple cysts may be found in kidneys otherwise normal. Their walls are thin, and project beyond the surface of the kidney, the contents are generally clear, colourless, or of a pale straw colour, and contain more or less albumen. But while solitary renal cysts are usually filled with such material, in a few instances they have been found to be occupied by blood stained fluid, or gelatinous matter, and in the contents of some cholesterine has been discovered. The development of these cysts is undoubtedly due to the same causes as lead to the development of multiple cysts, which will be referred to presently.

The solitary renal cyst is well illustrated by the specimen I now present to you. You will observe that there is a large thin-walled cyst, which projects from about the middle of the convex border of the kidney. The cortical substance entirely, and in great part also the pyramidal, has become destroyed, so that the cyst almost extends to the pelvis, yet does not open into it. The two cavities are still separated from one another by a thin wall of renal tissue. On microscopic examination the rest of the kidney is found to be healthy, except where more or less altered by the direct pressure of the cyst.

These new formations are seldom more than pathological curiosities, and even when large in size do not call for the intervention of the surgeon. The reason for this is that they rarely interfere with the function of the kidney, and hence, unless of considerable size, are not discovered during life.

In diseased kidneys cysts are more frequently seen. The whole kidney may be converted into a huge conglomeration of cysts of varying size and colour, and so closely packed together that, with the naked eye, it is impossible to detect a trace of renal tissue; but even although the organ is increased to ten or twenty times its normal bulk, its renal form is maintained by the enlarged mass. The degeneration generally affects both organs, although, perhaps, not to the same extent: and is not uncommonly associated with the formation of cysts in the liver and thyroid gland. The kidneys may not only attain such dimensions as to be felt during life, but a case has been recorded in which the organ so increased in bulk as to weigh sixteen pounds, and measured fifteen and a quarter inches in length. This very unusual case was published by Dr. Hare in the *Pathological Transactions* for 1850-51, and here you have a somewhat similar specimen from the Royal Infirmary Museum. It was removed from the body of a man aged 60; during life no renal disease was suspected, but after death both the kidneys were found to be the seat of cystic degeneration. This specimen (the right kidney) when removed from the body weighed 86 ounces. The smaller cysts are filled with firm, gelatinous material, while the contents of the larger are fluid and clear. Into some of these hæmorrhage has taken place, and has imparted to the fluid a yellow, red, or brown colour. The fluid, on microscopic examination, was observed to hold in suspension blood corpuscles, pus, and crystals of cholesterine. The walls of the larger cysts are exceedingly thin, and are composed of fibrous tissue, lined by tesselated epithelium.

It is difficult to trace the progress of the disease in a specimen in which the changes are so advanced as in the one just referred to, but, if a number of kidneys be examined, an explanation of the pathology of the disease will be easily found.

I have examined a large number of specimens of chronic tubular and interstitial nephritis, and have frequently found them to contain cysts of all sizes—from mere microscopic expansions of the uriniferous tubules to cysts capable of containing several drops of fluid. When the cysts are numerous, the disease appears to be uniformly distributed, and the whole kidney is converted into a conglomerate mass; but, if the cysts be few in number and small in size, they will be found most abundant in the intermediate zone between the medulla and cortex—namely, in the zone of limitation. In many specimens plugs of colloid material are seen, usually at a part of the uriniferous tubule where constriction has occurred; above this, the tubule is irregularly distended and contracted, so as to form a chain of minute cysts. The capsule of the cyst is formed by the connective tissue of the kidney, which is generally increased in amount and firmer in consistence than normal, but may be so scanty that one is almost led to believe that the boundaries of the cyst are formed of little more than the basement membrane of the uriniferous tubule. The epithelium lining the cyst is, as a rule, flattened and atrophied, and the contents always escape in preparing the section, even when the celloidin method is employed. Associated with the dilatation of the uriniferous tubules, there is generally marked atrophy of the rest of the parenchyma of the organ, and, as far as I have observed, always more or less interstitial nephritis. Whether the tubules become obstructed by epithelial debris, or tube-casts from within, or by the contraction of the inflammatory connective-tissue products around them, is a question at present difficult to answer. Probably both exercise a considerable influence in the production of the diseased condition. Cysts of small size are frequently observed in the cortex, and owe their existence to a constricted condition of the neck of Bowman's capsule, or obstruction of the tubule close to the Malpighian body.

The classification of cysts into primary and secondary seems to me to be a very artificial one, as the etiology and pathology of all these conditions are identical, and the diseases differ only in the time of their occurrence, and in their distribution and extent. It is a fact worthy of remark, that while cystic degeneration is, in its graver forms, always associated with either chronic interstitial or chronic tubular nephritis, in the case of the majority of specimens contained in our museums no renal disease was suspected during life.

Cystic degeneration of the kidney is not only of pathological interest, but also of clinical importance, as it has been confounded with ovarian cyst, and has been removed as such by several well known surgeons, amongst whom I may mention Peaslee, Esmarch, Campbell, Ollier, Archer, Leopold, Schedé, Keeling, and Goodell; and Wagner has published a case of Thiersch's in which this disease was mistaken for hydatid of the liver.

The symptoms of cystic degeneration of the kidney are essentially those of chronic Bright's disease, the cysts being in the majority of cases a consequence of chronic interstitial nephritis.

I will narrate to you shortly the history of the case from which this specimen was removed, but, before doing so, it is right for me to remark that, while both kidneys are converted into a congeries of cyst, a good deal of solid tissue remains, and under the microscope Malpighian tufts and uriniferous tubules can be detected. The patient, a man aged 43, was under the care of Professor Gairdner, in the Western Infirmary. The following history is taken from the Catalogue of the Western Infirmary Museum:—

"There were repeated attacks of hæmaturia, extending over 18 years. In later stages symptoms of vesical irritation were present. Tumour of kidneys was recognised. Death occurred with uræmic symptoms—*i. e.,* suppression of urine, delirium, and coma, lasting in all about 36 hours, and coming on suddenly two days after admission. Urine contained leucocytes and blood corpuscles. Just before the fatal attack its quantity was 30 oz., sp. gr. 1012·-15."

A few years ago I had under my care a patient, who, while suffering from the general symptoms of chronic Bright's disease, also complained of a swelling in both loins. At no time, however, was there any tendency to dropsical swelling, but he had occasional pains in the lumbar region, and not unfrequently hæmaturia was observed, but no albuminuria until within ten months of his death. During the last six months a few granular tube-casts were detected. The patient died suddenly from syncope, and at the *post-mortem* inspection the two large cystic kidneys, which I now show you were removed. The left ventricle was greatly hypertrophied without valvular disease.

Diagnosis.—The symptoms of cystic degeneration are, as I have already remarked, those of chronic Bright's disease, but superadded thereto there is a non-fluctuant swelling in one or both loins. The swelling is usually rounded, nodulated, not painful on pressure, slow of growth, and presents the physical characters of a renal tumour. In some instances hæmaturia may be present, but commonly no urinary symptoms other than those of Bright's disease are observed. If the patient has a sallow complexion, and on physical examination the heart is found to be hypertrophied, and arterial tension is increased; if the urine is albuminous, and contains granular tube-casts, the suspicion of cystic disease will be considerably increased.

In cystic diseases the renal swelling does not diminish and increase from time to time as in hydronephrosis, nor is there a history of sudden retention of the renal excretion.

We will not here consider the question of treatment, but it may be remarked that as far as operative interference is concerned this disease is unfavourable for nephrectomy, the lesion being as a rule bilateral, and when unilateral, it is almost always associated with other organic diseases of the kidney on the opposite side.

I now desire to direct your attention to the second variety of cystic diseases—namely, those due to hydatids or other parasites.

Although these diseases differ greatly in their pathology from the lesions which we have just been considering, it is more convenient to discuss them here than elsewhere.

In respect to hydatids, Neisser, who collected no less than 986 cases of hydatids in man, states that of all these the kidney was involved in only 80, and Davaine has shown in his elaborate statistics, that in 566 cases of echinococcus in man the kidney was affected in only 30 instances. The researches of others corroborate the accuracy of these statements. When it is borne in mind that echinococcus may attack any portion of the body, one would expect the kidney to be more frequently involved in the disease. In connection with this point Ebstein remarks, "The cause of the kidney being relatively less frequently involved is to be found in the fact that the young animals can find their way out of the stomach more rapidly and easily into the liver. Of the reasons why in other cases, however, they wander directly into the kidneys, and at the same time often leave all the other organs free, we are unable even to form a supposition."

Hydatid cysts may occupy one or both kidneys, or be limited to one end of one organ, the remainder being healthy. Any part of the kidney may be attacked, the cortex, medulla, or pelvis; rarely, however, does the parasite attack the latter alone. In this situation it causes atrophy of the parenchyma, until ultimately the entire organ is destroyed, either as a consequence of pressure, or of suppuration within the cyst. In a considerable proportion of the cases of renal hydatids, the growth has attained such a size as to be palpable during life, and has been mistaken for an ovarian tumour.

Spiegelberg operated on a woman, 42 years of age, but, instead of the expected ovarian cyst, found a renal echinococcus. The tumour had been developing for one and a half years in the right hypogastrium, and had attained the size of a man's head. It was very elastic, irregular, very moveable, and a slight murmur resembling the uterine souffle could be heard over it. A part of the tumour extended for a short distance into the anterior portion of the pelvic inlet. It was hard, painless, and situated close under the abdominal wall. The tumour could be removed only incompletely with a portion of the right kidney. The adhesions with the surrounding parts were firm and numerous. In this case, as Spiegelberg rightly states, the exploratory puncture would have been the only means by which the lamentable error could have been prevented. Only in that way could the possibility of its ovarian origin have been excluded. The hydatid fremitus was wanting in this case.

These cysts of the kidneys are rounded in form and fluctuant, and when the parasite is seated in the cortex, or immediately beneath the capsule, the growth may attain considerable dimensions. The echinococcus has a great tendency to rupture into the renal pelvis. Dr. Roberts shows the following results from an investigation of 63 cases in which hydatids were found in the kidney, or passed by the urethra:—

In 47 cases the cyst opened into the pelvis of the kidney.
In 1 case, into the pelvis of kidney and lungs.
In 3 cases, into the pelvis of kidney and intestine.
In 1 case, into the pelvis of kidney and stomach.
In 1 case, into lungs alone.
In 8 cases, did not open at all.
In 2 cases, opened artificially.

It will be seen from these figures that in 52 out of 63 cases hydatids were discharged by the urethra.

In this country, hydatid cysts of the kidneys are very uncommon, and are even more so in America; while in Iceland, some parts of Germany, in Silesia, and in Australia, the disease is frequently met with. I have, however, here two preparations from the Western Infirmary Museum. The first is a specimen which was sent to the Museum by Drs. J. Lindsay Steven and John Fotheringham. This one shows that the kidney has been converted into a large loculated cyst, measuring in its greatest length 7½ inches; in breadth, 4½ inches; and in depth, about 3 inches. Practically no renal tissue remains; the upper portion of the tumour has adhering to it a portion of the diaphragm. The ureter is seen with a piece of whalebone passed through it into the interior of the cyst; the ureter is very greatly dilated, and its walls are much thickened. The cavity in the kidney was filled with daughter cysts, which readily escaped when, at the *post-mortem* examination, the thin anterior wall of the tumour was ruptured, and some are now seen lying at the bottom of the jar, while a few have been replaced within the parent cyst. An examination of the contents of these cysts showed that they were filled with a clear non-albuminous fluid, in which small white granules were floating. These, on microscopic examination, proved to be the echinococcus heads. Half of the opposite kidney is also seen, and its surface presents a coarsely nodulated appearance. On microscopic examination, the organ, in addition to presenting considerable interstitial new growth, is seen to be the seat of extensive amyloid disease.

The case occurred in the practice of Dr. Fotheringham, of Motherwell, and was seen, on two occasions, by Dr. J. Lindsay Steven in consultation with that gentleman. The patient was a married woman, aged 30, and came under observation on account of symptoms of acute Bright's disease of about two month's duration. About a fortnight afterwards a tumour was discovered filling the right lumbar region. Suddenly, after pain complained of in the line of the right ureter, a number of cysts were discharged along with a quantity of pus. The cysts, on examination by Dr. Steven, were found to present the typical characters of echinococcous vesicles. These discharges occurred at longer or shorter intervals until the patient's death a month or two afterwards.

The second example of this disease was from a patient who died in Dr. Tennent's ward.

The kidney was replaced by a large tumour consisting of a nearly globular cyst. At the lower end of the tumour there is the remains of the kidney seen in section in the preparation, and it is as if the cyst had opened up and pushed aside the kidney tissue, without producing any other considerable alteration. The cyst was filled with pultaceous material like very soft putty, which was found to consist mainly of oil and cholesterine with some lime salts. The wall of the cyst is partly infiltrated with lime, and the internal surface has a very irregular appearance, not unlike that of the aorta in advanced atheroma.

On dividing the cyst, the kidney and suprarenal capsule are found to be spread out to a considerable extent on its anterior and *inner* surfaces. The pelvis of the kidney being greatly elongated. The cyst itself has no connection with the pelvis, and its wall is quite distinct from the kidney tissue, although firmly adhering to it. In the cyst were many irregular pieces of soft membrane, which, on microscopic examination, presented the stratified appearance of hydatid cyst wall.

In the first case daughter cysts were discharged during life by the urethra, and enabled the medical attendants to make a definite diagnosis during life, but as you will observe in the second specimen, there is no communication between the pelvis of the kidney and the new formation.

The *symptoms* of renal hydatids are often very obscure. The growth may attain considerable dimensions without its presence being evinced either by pain or febrile symptoms.

This is so when the cyst does not communicate with the pelvis of the kidney. In such cases there is no interference with the elimination of the renal excretion. In many, however, the cyst ruptures into the pelvis, when obstruction to the flow of urine and pain are early symptoms. Beyond the presence of the cyst contents the urine is generally normal, unless the disease is complicated by pyelitis. When rupture of the cyst occurs, the fact is evinced by the presence of fragments of the cyst in the urine, and by the existence of pyuria or renal colic.

The *physical signs* are those of renal tumour, but while this is so as a rule, hydatid cysts vary more than other tumours in their position with reference to the colon.

This is probably explained by the circumstance that cysts, during their early stage, only involve a small portion of the organ, and in their development, extend outwards, dissect the peritoneum from the abdominal wall, and press the colon towards the middle line. They seldom rupture into the peritoneal cavity. Their contents may, however, escape into the respiratory passages through the diaphragm into the pleura, they may also open into any of the hollow abdominal viscera, or by suppuration the contents of the cyst may be discharged externally.

The *diagnosis* is in some cases extremely simple, in others almost impossible. When marked renal colic occurs, followed by the discovery of echinococcous vesicles in the urine, the diagnosis is almost certain; and if the indications just mentioned be accompanied by the physical signs of renal tumour, and, simultaneously with, or following the attack of renal colic, there is a sudden diminution in the bulk of the swelling in the loin, the diagnosis is absolutely certain. In doubtful cases where the cyst has not ruptured into the renal pelvis, and the urine does not give evidence of the character of the lesion, the fact that it is renal may be demonstrated by puncturing the cyst, and withdrawing a portion of its contents. This procedure has a double advantage; not only does it clear up the diagnosis, but it is also a useful means of treatment. The fluid so procured has a specific gravity of about 1009 to 1014, its reaction is neutral, it is clear, colourless, transparent, and does not as a rule, contain albumen. But while this is generally the case, the presence of albumen does not prove the fluid to be not hydatid, as in some instances the contents of a hydatid cyst are albuminous. This is especially apt to be so if the cyst has been previously opened.

The fluid usually contains a quantity of chloride of sodium, and may have suspended in it cholesterine crystals, uric acid, triple phosphates, oxalate of lime, or hæmatoidin crystals. For the purpose of examination the urine should be placed in a conical glass, and set aside for some hours, to allow any hooklets that may be present to deposit. The presence of these bodies is pathognomonic of hydatid disease, but it requires other evidence before we are entitled to conclude positively that they are of renal origin. This is so even when they escape by the urethra, for in a few instances echinococcous cysts have been known to rupture into the bladder and other portions of the urinary tract when the disease does not involve the kidney. In such cases the nephritic colic, which usually accompanies renal hydatids, is absent.

The diagnostic significance of so-called hydatid fremitus, when it can be obtained, is great, and may be elicited when the tumour is tense. The cyst should be compressed by the second finger of the left hand, and a slight sharp tap should be given to it with the finger of the right hand. The finger should be allowed to rest for a short time, when a peculiar vibratory thrill will be communicated to the left hand. This is hydatid fremitus. When felt it is of great value, but its absence is of no significance. Its duration is uncertain, sometimes brief, but frequently prolonged.

When the cyst ruptures into the renal pelvis the course of the disease is generally favourable. Notwithstanding, however, cases have been recorded where the patient has continued to pass vesicles at longer and shorter intervals for twenty or even thirty years. Davaine mentions a case of a woman who suffered from attacks of renal colic, accompanied by the escape of cysts by the urethra during a period of twenty years. Death may ensue from rupture of the cyst into some important viscus, or by a solitary kidney becoming the seat of the disease. When the tumour is small in size, and located close to the pelvis, the prognosis is favourable. This is especially so if the kidney be the only organ involved. When the tumour attains considerable size, or when it shows a tendency to suppurate, the prognosis is less favourable. If, however, the pus is permitted to escape freely, danger to life is proportionately diminished.

I may now turn for a few moments to direct your attention to the third variety of cystic disease—namely, that form of it which occurs in the fœtus *in utero*. This condition has acquired the dignity of a sub-division of cystic disease because of the period of its appearance rather than because of any distinction in its etiology and pathology. As in acquired cystic degeneration, the lesion in the kidney is due to some obstruction to the escape of urine. According to Virchow, the retention of the excretion is due either to an embryonic nephritis, causing narrowing of the uriniferous tubules, or to impaction of the straight tubules with uric acid, both of which ultimately lead to an atrophy of the papillæ and obliteration of the pelvis of the kidney. Köster, who has also written on the etiology of the disease, assumes that the primary lesion is a malformation of the lower urinary tract, by which the escape of urine is prevented. The latter view is supported by the circumstance that congenital cystic kidney is frequently associated with malformations of other parts. In his book on *Diseases of the Kidney*, Morris describes a case in which "both kidneys were wholly composed of cysts; and the anus, rectum, urethra, and external genital organs were absent. Besides, the bladder was misplaced or malformed, the sigmoid flexure was malformed, the uterus was arrested in its development, and the outlet of the pelvis was smaller than natural." In another case of congenital cystic transformation, Sir William Gull describes the urine-conducting apparatus as having been occluded, and Heusinger observed an example of cystic disease of the right kidney, associated with congenital absence of the lower extremity, and female genitals on the same side of the body, while on the opposite side nothing abnormal was found.

These cases strongly support Köster's views. On the other hand, a few cases have been recorded in which congenital cysts were discovered unassociated with any disease or malformation of the conducting or collecting portions of the urinary tract. In such instances the presence of the lesion in the kidneys can only be accounted for by adopting Virchow's theory. Although of interest to the morbid anatomist, these congenital cysts of the kidney are of no practical importance to the surgeon.

We now come to consider the *treatment* of the diseases we have been discussing in this lecture. In the treatment of hydronephrosis it is necessary to bear in mind the great variety of lesions which may lead up to a dilatation of the renal pelvis, and also the circumstance that the distention is slow in development, and rarely fatal in its issue. When it can be shown that the obstruction is not due to organic disease, such as malignant or simple tumours of the pelvic or abdominal organs, stricture of the urethra, enlarged prostate, bands and adhesions, tubercular disease or tumours in the bladder, but rather to lesions such as displacements of the pelvic organs or of the kidneys, renal calculi, or to the entrance of the ureter into the pelvis at an acute angle, then manual pressure, manipulation or friction over the tract of the ureter, or upon the sac may give relief. This treatment may be aided by the use of sedatives, anti-spasmodics and hot baths. Otherwise therapeutic agents are of little value.

In the *Lancet* (May 1887), Bennett advocates manipulation without incision as a possible treatment of certain cases of stone in the kidney, and narrates a case of an unmarried woman, thirty years old, who was suspected of having a renal calculus in the left kidney :—"The patient having been laid on her back upon a couch, the fingers of my left hand were dipped deeply into the abdominal wall over the kidney, the right hand being pressed forwards into the loin. By a little management, the muscles being quite flaccid from the patient having become faint, the kidney could be felt quite easily between the two hands, and was kneaded as thoroughly as the circumstances allowed. The patient, although much discontented with the aching and tenderness which the operation seemed to have caused, was well enough to walk away almost directly afterwards.

"Two days later she reappeared at the hospital in a more grateful mood, saying that, having suffered much discomfort for the rest of the day after the manipulation, she was seized, as she was going to bed, with a most acute pain in the affected loin and side of the abdomen. The pain lasted for about half an hour, during which she vomited twice. All at once an uncontrollable desire to micturate occurred, and the pain immediately ceased. No further pain followed, and their can be little doubt that a small calculus had made its way down the ureter into the bladder, although no evidence of its having passed "per urethram" was forthcoming. Moreover, it is quite possible that the manipulation had moved the stone from its resting place in the kidney, and thus brought about its expulsion.

"I am aware that an isolated case like the above cannot be taken to necessarily prove much, since the passage of the calculus may have been a mere coincidence; at the same time I am strongly disposed to attribute the result to the manipulation. This view receives some corroboration from a case which was under the care of one of my colleagues, in which the kidney was exposed and examined without the detection of a stone, although shortly afterwards an attack of renal colic was followed by the expulsion of a very small calculus, which had probably been disturbed during the exploration. Other similar cases have, I believe, occurred. As bearing on the same point, I may here say that it seems most probable that when relief has followed the exposure and manipulation of the kidney without the detection of a stone, the result has been due to an alteration in the position of the calculus produced by the kneading to which the organ has been subjected. That calculi of *considerable size* may be overlooked both in the lumbar and combined abdominal and lumbar operation for exposing the kidney when the organ is examined by the fingers only is certain, and it is, I believe, from our experience at St. George's Hospital, equally certain that only stones of the smallest size can escape detection when the kidney is thoroughly explored by acupuncture —an operation which has been at present associated with risks which are hardly more than problematic, and at all events less serious than the danger which exists of overlooking calculi of no small size when digital examination is alone employed. Manipulation of the kidney through the parietes without previous incision is possible in certain cases, the number of which is far larger than is generally supposed, when the abdominal walls are not too much loaded with fat and the muscles have been completely relaxed by the administration of an anæsthetic. Indeed, I believe the kidney to be, as a rule, far more movable and less fixed in the loin in the living subject than it is usually described to be. In conclusion, I venture to suggest that manipulation without incision is a proceeding worthy of trial as a treatment which may possibly prove of utility in certain cases of renal calculus, not too far advanced as a means of changing the position of the stone and perhaps effecting its expulsion—a possibility, to my mind, sufficiently strong to commend the process to the attention of physicians as an adjunct to the medical treatment of renal calculus."

When the hydronephrosis is caused by a displacement of the uterus, or of the kidney on the affected side, attempts should be made to cure the primary disease, and thereby remedy the secondary one. In cases of obstruction by renal calculi, benefit may also be looked for from rubbing or careful manipulation of the ureter, with the purpose of facilitating the passage of the stone into the bladder. Manipulation has also been successfully practised in hydronephrosis occurring in children. The first case recorded was a patient of Mr. Thurnam's (*London Medical Gazette*, 1837). The child, aged four months, had a tumour in the abdomen, which varied in bulk from time to time, and was found to be due to a dilated condition of the ureter. When the abdominal swelling was rubbed it was found to diminish in size, while at the same time the bladder became distended with fluid. Dr. Roberts' case is also an interesting one on account of its complete success. The patient, a female, aged eight years, suffered from a unilateral hydronephrosis. By manipulation every second morning, after the third application the sac suddenly emptied itself into the bladder, a large quantity of urine was evacuated, and the cure was complete and lasting. A third case, one of large double congenital hydronephrosis, is recorded by Dr. Broadbent, in the *Pathological Transactions*, vol. xvi. The patient was three months old, and suffered from a large swelling in the abdomen, unassociated with suppression of urine. With manipulation and friction the fluid accumulation disappeared, followed by a profuse discharge of urine.

Such cases are unfortunately not common, and it must be apparent to you that the treatment just referred to must be practised with great care and only in those cases in which it does not give rise to pain, where the distention is moderate and presumably due to an obstruction not involving organic change.

Puncture with a trocar and cannula, for the purpose of drawing off the fluid, when the evacuation of the sac is demanded, on account of dangerous pressure symptoms, is an old and very imperfect mode of treatment, and one not free from danger. It is of little value, as the sac is likely to refill within a limited time. M. Dieulafoy (*Gaz. Hebdomadaire*, 1887) narrates a case in which he cured a suppurating hydronephrosis by aspirating the fluid forty-seven times, during a period extending over three years.

Dr. Coghill also cured a case of hydronephrosis by tapping, and Mr. Croft effected a complete cure in a case of hydronephrosis resulting from injury, by drawing off the fluid on eight successive occasions, during a period of little more than three months. Thompson, of Nottingham, also relates a case of tapping, in which the patient was able to follow his occupation for more than eight years, but ultimately died from rupture of the sac into the peritoneal cavity. Hellier in a case of congenital hydronephrosis, obtained a good result after repeated operations, and Wölfler succeeded in curing a patient under his care by three aspirations combined with the injection of a weak solution of iodine.

Of 29 cases of tapping for hydronephrosis 7 recovered from the operation, with cure of the disease, while 4 underwent temporary improvement; the remaining 18 died. Aspiration gives more favourable results in so far as mortality is concerned, but seldom effects a complete cure. Paracentesis is therefore not an operation to be recommended unless in very exceptional cases, but should it be determined on, the puncture should be made, when the hydronephrosis is on the right side, at a point two inches and a half behind a line drawn from the coracoid process of the scapula to the anterior superior spinous process of the ileum, midway between the crest of the ileum and the last rib. The needle should be directed towards the spine. If the left kidney is the seat of the disease the puncture may be made an inch higher unless there is evidence of considerable enlargement of the spleen.

Repeated tapping is only likely to effect any good result in those cases in which the secreting power of the kidney has been completely destroyed; should any urine secreting tissue remain, it is evident that repeated aspirations will be necessary before complete collapse of the cyst can be finally brought about.

There is, however, another danger besides that of re-accumulation—namely, the risk of septic infection, which may result in suppuration of the sac, perinephritic abscess, suppurative nephritis, or uræmia, all of which have caused death as a consequence of puncture of hydronephrosis. Should it suppurate spontaneously, or from tapping, the question next arises—Is the sac to be freely incised and drained, or are it and the kidney to be excised together? Both operations, as will be seen from the following statistics, have been performed in a considerable number of cases. The method of operating will not be discussed at present; the only consideration I will submit to you now is—What operations should be selected in certain cases?

Previous to 1878 attempts had been made to obliterate hydronephrosis by frequent puncture and drainage with a trocar and cannula, but to Dr. Robert Weir, of New York, is due the credit of having in that year first practised nephrotomy in a case of hydronephrosis. The patient, a man, aged 21 years, suffered from a painful swelling in the abdomen, unaccompanied by hæmaturia or retraction of the testicle. A few ounces of clear fluid were withdrawn by an aspirator, and on examination were found to contain neither the hooklets of hydatids nor urea. After a second attempt to empty the cyst by tapping, the fluid re-accumulated in increased quantity, when Dr. Weir resorted to nephrotomy. The operation was performed on the 20th December, 1878, in the lumbar region, the cyst was evacuated, and free drainage established. By July, 1879, recovery was complete.

Since 1878, I find that nephrotomy for hydronephrosis has been performed 15 times (abdominal 3, lumbar 12), without a single death, so that the incision of a hydronephrosis without suppuration cannot be regarded as a serious operation, except for the danger of establishing a permanent urinary fistula. When suppuration has taken place within the sac it is more correct to describe the case as one of pyonephrosis. I have, therefore, excluded all such cases from my table of nephrotomies or hydronephrosis (p. 156).

In many cases of nephrotomy for hydronephrosis a permanent fistula remains in the loin, but, while this is so, it is difficult to premise how much discomfort to the patient may result therefrom. In cases where the kidney on the opposite side has been ascertained to be healthy, and in which the urinary fistula causes such inconvenience to the patient, by the offensive and injurious nature of the discharge, as to render life intolerable, lumbar nephrectomy may be practised. Or that operation may be resorted to without previous nephrotomy when it has been ascertained that suppuration has taken place in the sac, or that the tissue of the organ on the affected side has become completely destroyed, while its neighbour is known to be able to take up double duty. By previously performing nephrotomy, a large sac may contract considerably, or the operation may ultimately effect a cure without further interference. If this favourable result is not attained the patient may be so relieved of his immediate distress as to improve considerably in general health, and if strict antiseptic precautions be taken the patient runs little risk of suppuration of the sac from septic infection.

In order to re-establish the patency of the ureters, catheterisation from above downwards has been advocated, but has not been practised with much success.

The following table, page 158, contains thirty nephrectomies for hydronephrosis. It will be observed that many of these operations were undertaken before the true nature of the case was determined, and in most of the earlier operations the diagnosis was not only incomplete but wrong.

In four instances the hydronephrosis was diagnosed as ovarian cyst, by Meadows, Billroth, Haywood Smith, and Bardenheuer.

The danger of mistaking hydronephrosis for ovarian disease is not so great as that of confusing the diagnosis of the latter with cystic degeneration. To this I have already referred, page 132, and Thiersch has published a case in which the hydronephrosis was mistaken for a hydatid cyst of the liver. With some of these cases in view, it is not surprising that Dickinson, in referring to the causes of death in cases of hydronephrosis, should remark:—"The greatest dangers which hydronephrosis entails are in the surgical procedures which it suggests, chiefly by its deceptive resemblance to ovarian disease." But while this is true, it is also true that if these mistakes in diagnosis had not been made, and faithfully recorded, our present knowledge of renal surgery would have been still little advanced. Although perhaps some may urge that "renal surgeons" are now too apt to recommend "heroic operations" for the relief of conditions, which might be more effectually dealt with by milder methods, still, it must be remembered that almost always, when new modes of procedure come into operation, there is a tendency towards their being employed without due regard to the individual peculiarities of the case.

Of the thirty operations for removal of the kidney for hydronephrosis without suppuration, eleven were lumbar, with three deaths; and eighteen were abdominal with nine deaths; and in one (Case XII) in which the combined lumbar and abdominal operation was performed the patient recovered. Only one abdominal nephrectomy was performed on a man, the remaining seventeen being upon women, hence the higher mortality in females than in males.

The following summary will show the general results:—

OPERATIONS FOR HYDRONEPHROSIS WITHOUT SUPPURATION.

	Males.	Females.	Recoveries.	Deaths.
Lumbar Nephrotomies,	5	7	12	—
Abdominal ,,	—	3	3	—
Lumbar Nephrectomies,	7	4	8	3 = 27 °/o
Abdominal ,,	1	17	9	9 = 50 °/o
Combined Lumbar and Abdominal,	—	1	1	—
	8	22	18	12 = 40 °/o

The causes of death in the twelve fatal cases were as follows:—

	Abdominal.	Lumbar.	Nos. of Cases.
Hæmorrhage,	1	—	5
Peritonitis,	2	—	7, 30
Pyæmia,	1	—	11
Uræmia,	—	1	17
Shock and Collapse,	3	1	4, 25, 34, 39
Acute Mania,	1	—	33
Cause Unknown,	1	1	23, 42
	9	3	

To summarise the treatment of hydronephrosis *without suppuration*, it may be stated, First, that the cases of chronic hydronephrosis are rare which call for operative interference. In such as demand surgical aid there are perhaps a very few which may be benefited by repeated tappings (those caused by torsion or angular insertion of the ureter), or by manipulation over the tract of the ureter (those caused by impacted calculus). Second, in the majority of cases requiring operation, free incision in the lumbar region, with drainage under careful antiseptic precautions, and irrigation effected by a large tube, is the treatment required. In some cases, an attempt may be made to restore the patency of the ureter by catheterisation from above. Third, when the circumstances of the case demand nephrectomy the lumbar operation should be performed after nephrotomy, and only when the other kidney is known to be healthy. In cases where the sac has suppurated immediate nephrectomy is the best treatment, as a rule, but necessarily the circumstances of the individual case must be carefully considered. If the cyst be a very large one, it may be necessary to perform the abdominal operation. Preliminary evacuation, should, however, be first practised.

The treatment of cystic disease of the kidney, being that of interstitial nephritis, falls to the physician rather than to the surgeon, whose aid is seldom asked in such cases, where the diagnosis is correctly made. Upon many patients affected with this disease nephrectomy or nephrotomy has been performed under a mistaken idea of the nature of the case. As I pointed out, in studying the history of nephrectomy in hydronephrosis, the earlier operators mistook cystic degeneration of the kidney for ovarian disease. As cystic degeneration is usually bilateral, and associated with chronic interstitial nephritis, it is not a disease calling for nephrectomy, nor, seeing that the cysts are multilocular, and widely distributed throughout the organ, is the patient likely to be benefited by tapping or nephrotomy. In cystic degeneration surgical interference is contraindicated.

In two operations of lumbar nephrotomy and in four of abdominal, the patients all recovered (page 157). In those of excision the mortality was very high. Of sixteen cases six died, when the abdominal incision was employed, but in the two lumbar nephrectomies both patients recovered.

The following statistics include one case of hydatids of the kidney operated upon by Spiegelberg, which resulted in death from collapse, twenty-six hours after the operation:—

OPERATIONS FOR CYSTIC DEGENERATION OF THE KIDNEY.

	Males.	Females.	Recoveries.	Deaths.
Lumbar Nephrotomies, .	—	2	2	—
Abdominal ,, . .	—	4	4	—
Lumbar Nephrectomies, .	2	—	2	—
Abdominal ,, . .	1	13	8	6 = 36 °/o

CAUSES OF DEATH.

	Abdominal.	Lumbar.	Nos. of Cases.
Peritonitis, ...	2	—	1, 13
Uræmia, ...	1	—	40
Shock and Collapse, . .	2	—	20, 21
Œdema of Lungs, . .	1	—	2
	6	—	

Concerning hydatid disease, we have nothing to do here with prophylactic treatment; it is only to treatment as applied to the cyst, so as to aid its evacuation, that we will devote our attention.

No internal medicaments appear to influence the life history of the parasite, or the bursting of the cyst, but after rupture has taken place it may be of advantage to facilitate the evacuation of the cyst by washing out the parasites. This is best done by ordering the patient large quantities of fluids, so as to induce diuresis. With a similar object in view gentle friction in the course of the ureter, applied either by the patient himself, or by an attendant, may palliate the pain of renal colic, and at the same time facilitate the progress of the cysts from above downwards, and, during the attack, if the pains be very severe, warm baths, hot fomentations, the subcutaneous injection of morphia, or the exhibition of other preparations of opium may be found useful.

Not unfrequently the ureters become dilated, and thereby the progress of the parasite is facilitated, so that such considerable masses may escape into the bladder, that difficulty may be experienced in the passage of the cysts into or along the urethra. If they cause interference with micturition, then means must be adopted to remove them.

Should cysts become impacted in the ureter, or considerable pain and inconvenience be suffered, or if the cyst increase in bulk so as to cause danger to life, without its contents escaping per urethram, the question of operative interference may be raised. Various methods have been proposed, the simplest and probably the most efficacious is to cut down upon the cyst, evacuate its contents, and stitch the edges of the cyst to the parietes. This operation has been performed frequently, and with satisfactory results. Thiriar, Imlach, and Péan have recorded recoveries after nephrotomy, but in a nephrectomy, by Spiegelberg, the patient died from collapse.

Because of the success of puncture of hydatids of the liver, the same treatment has been proposed for hyatids of the kidney, and it is true that in some favourable cases a surgical operation of this kind has been followed by a diminution in the size of the cyst.

NEPHROTOMIES FOR HYDRONEPHROSIS AND CYSTIC DISEASE OF KIDNEY.

No.	Date.	Observer and Reference.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	20. xii. '78.	Weir. *Med. Record*, March, 1880.	M., 21	Lumbar.	Hydronephrosis of right kidney.	5 mos.	Catheterisation of ureter without result.	—	R.
2	1878.	Pernice. *Staple's Statistics.*	F., 23	Do.	Ovarian cyst.	—	Hydronephrosis; recovery, fistula remaining.	—	R.
3	1879.	Ahlfeld. *Arch. f. Gynæk.*, 1879, xv, 114.	F., 27	Do.	Ovarian cyst.	—	Hydronephrosis of wandering kidney; cure, with fistula.	—	R.
4	1880.	Svensson. *Staple's Statistics.*	F., 47	Do.	Hydronephrosis.	—	Recovery, fistula remaining.	—	R.
5	1880.	Peters. *New York Med. Rec.*, 6. v. 1882.	F., 47	Do.	Do.	—	Cure, with fistula.	—	R.
6	1880.	Rupprecht. *Centralb. f. Chir.*, v. 1885.	F., 9	Abdominal.	Hydronephrosis of right kidney.	5 years.	Death 5 years after from an intestinal affection; urinary fistula; *post-mortem;* complete obstruction of right ureter.	—	R.
7	3. viii. '81.	Kehrer. *Arch. f. Gyneak*, xviii, 1881.	F., 32	Do.	Hydronephrosis of right kidney.	5 years.	Tumour size of man's head; urine normal.	—	R.
8	1882.	Tuckwell. *Lancet*, 1882.	M., 11	Lumbar.	Congenital hydronephrosis of left kidney.	—	Suppuration for 13 weeks; complete recovery.	—	R.
9	15. iv. '82.	A. T. Cabot (Boston, U.S.) (Private.)	M., 10	Do.	Hydronephrosis.	4 mos.	Diagnosis confirmed.	—	R.
10	ix. '82.	Leopold (Dresden). (Private.)	F., 35	Abdominal.	Do.	2 years.	Diagnosis confirmed.	—	R.

11	22. viii. '83.	Bardenheuer. (Private.)	F., 12	Lumbar.	Hydronephrosis.	—	Acute hydronephrosis; recovered from operation, but died of amyloid disease subsequently.	—	R.
12	1884.	John Duncan. (Private.)	F., 40	Injection with iodine and drainage.	Do.	Many years.	—	—	R.
13	21. i. '85.	Wm. Ingalls, (Boston, U. S.) (Private.)	M., 43	Lumbar.	Do.	18 mos.	Cause of obstruction not discovered: condition improved by operation; Died May, 1886.	—	R.
14	ii. '86.	Golding-Bird (London). (Private.)	F., 35	Do.	Do.	12 mos.	Obstruction of ureter incomplete; probably calculus	—	R.
15	17. iv. '86.	Nicaise (Brodeur).	M., 60	Do.	Hydronephrosis of right kidney.	—	Chronic retention of urine.	—	R.
16	v. '80.	Thornton (J.K.) *Intern. Med. Cong. Rep.*, ii, 154.	F., 27	Abdominal.	Cyst opening into left ureter.	5 years.	Abdominal incision in the course of ureter, and drainage in loin.	—	R.
17	2. vi. '80.	Landau. *Berl. Klin. Woch*, 13. xvii, 1883.	F., 60	Do.	Hydronephrosis with suppuration of right kidney.	Several years	Cystic kidney: urinary fistula established.	—	R.
18	23. xi. '81.	Schramm. *Berl. Klin. Woch.*, Sept., 1883.	F,, 47	Do.	Hydronephrosis of right movable kidney.	6 mos.	Cystic kidney; persistence of a fistula, but tumour not appreciable.	—	R.
19	2. xii. '81.	Péan (Brodeur). 140.	F., 37	Lumbar.	Purulent cyst of left kidney.	—	Diagnosis confirmed.	—	R.
20	3. viii. '84.	Taylor. *Lancet*, 4. xii. 1884.	F., 15	Abdominal.	Hydronephrosis of left kidney.	—	Cystic kidney; persistence of a urinary fistula.	—	R.
21	20. vii. '81.	W. Goodell (Philadelphia) (Private.)	F., 30	Lumbar.	Renal Cyst.	2 years.	Diagnosis confirmed.	—	R.

NEPHRECTOMIES FOR HYDRONEPHROSIS AND CYSTIC DISEASE, &c.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	iv. '68.	Peaslee (New York). (On Ovarian Tumours), 1872, p. 158.	F.	Abdominal incision.	Ovarian cyst.	—	Cystic kidney; died fifty hours after the operation from peritonitis.	D.	—
2	15. xi. '69.	Esmarch (Berlin). *Schetelig. Arch. f. Gynæc.*, 1870.	F., 19	Abdominal.	Left ovarian cyst.	Congenital.	Large cyst of kidney with pelvic adhesions; death in thirty-six hours from œdema of lungs.	D.	—
3	26. vi. '67.	Spiegelberg (Breslau). *Arch. f. Gynæc.*, 1870, i, 146.	F., 42	Do.	Ovarian cyst (right).	1 year.	Removal incomplete; hydatid cyst of kidney; died twenty-six hours after operation from collapse.	D.	—
4	3. iv. '70.	Parker. (Private.)	F., 12	Do.	Hydronephrosis of right kidney.	—	Disorganisation of the kidney; tumours; hydronephrosis; death next day from shock.	D.	—
5	24. vi. '71.	Meadows (London). *Brit. Med. Journ.*, 1871.	F., 24	Do.	Ovarian cyst (right).	—	Large cystic kidney; died on the sixth day from hæmorrhage.	D.	—
6	2. xii. '73.	Campbell (Dundee). *Edin. Med. Journ.*, 1874, p. 36.	F., 49	Do.	Do.	—	Cyst involving lower third of kidney.	—	R.
7	13. vii. '76.	Billroth (Wien). *Wölfler. Arch. f. Klin. Chir.*, xxi, p. 694.	F., 46	Do.	Do.	Congenital.	Hydronephrosis of right kidney; death on second day from peritonitis.	D.	—
8	6. x. '79.	Czerny (Heidelberg). *Arch. f. Klin. Chir.*, xxv, 862.	F., 37	Do.	Hydronephrosis.	8 months.	—	—	R.

9	3. i. '80.	Thornton (London). *Lancet*, 1880, i, 871.	F., 7	Abdominal.	Hydronephrosis (left side).	5 years.	Ureter compressed by fibrous band.	—	R.
10	16. i. '80.	Savage (London). *Lancet*, 1880, vol. i.	F., 56	Do.	Do.	4 years.	Hydronephrosis.	—	R.
11	3. iii. '80.	Czerny. *l.c.*, p. 863.	F., 40	Do.	Hydronephrosis of a movable kidney.	—	Patient died in six weeks from pyæmia with abscess in lungs, kidney, and pelvis.	D.	
12	29. v. '80.	Spiegelberg. *Kroner, Arch. f. Gynæk.*, xvii, 1887.	F., 27	Abdominal and lumbar.	Hydronephrosis.	4 years.	Much improved six months after operation; cause of hydronephrosis, urethral valve.	—	R.
13	viii. '80.	Ollier (Lyons). *Acad. de Méd.*, ix, 1883.	F.	Abdominal.	Ovarian cyst.	—	Cystic kidney; died on third day from peritonitis.	D.	—
14	14. ix. '80.	Archer. *Lancet*, 1882, p. 1,070.	F., 50	Do.	Ovarian tumour.	8 years.	Recovery in six months; cyst in right kidney, weighing 5 lbs. and containing 18 pints of fluid.	—	R.
15	—	Bardenheuer. (Private.)	F., 5	Lumbar.	Hydronephrosis of left kidney.	5 months.	Recovery in six weeks; kidney contained numerous abscesses.	—	R.
16	14. iv. '81.	Le Dentu (Paris), *Centb. f. Chir.*, ix, 1882.	M., 32	Do.	Hydronephrosis, with fistula.	8 years.	Kidney greatly atrophied.	—	R.
17	17. vi. '81.	Czerny (Heidelberg). *Brann. de Med. Woch.*, xxxiii, 1881.	M., 33	Do.	Hydronephrosis.	2 years.	Right kidney hydronephrosed; atrophy of left kidney; death in 26 hours from uræmia.	D.	—
18	3. viii. '81.	Kehrer (Heidelberg). *Arch. Gynæk.*, xviii, 371.	F., 32	Abdominal.	Do.	2 years.	Hydronephrosis with considerable atrophy of renal substance.	—	R.

NEPHRECTOMIES FOR HYDRONEPHROSIS AND CYSTIC DISEASE, &c.—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
19	23. x. '81.	Leopold (Leipsig). *Arch. Gynæc.*, xix, 129.	F., 33	Abdominal.	Left ovarian tumour.	6 years.	Huge cyst containing blood, attached to lower end of left kidney.	—	R.
20	—	Burgess (San Francisco). *Western Lancet*, 1881.	M., 53	Do.	Large cystic kidney.	—	Death from shock.	D.	—
21	20. iii. '82.	Schedé. *D. Med. Woch.*, ii, 702, 1882.	F., 26	Do.	Right ovarian cyst.	—	Died day after operation from collapse; cyst contained originally about three letres of blood-stained serum.	D.	—
22	26. iv. '84.	Bardenheuer. (Private information).	M., 42	Lumbar.	Cystic kidney.	—	Diagnosis confirmed.	—	R.
23	16. iii. '82.	Heywood Smith (London). (Private.)	F., 42	Abdominal.	Ovarian cyst.	—	Hydronephrosis of right kidney; death on next day; cause unknown.	D	—
24	13. v. '82.	Thiersch (Leipsig). *Wagner. Arch. f. Klin. Chir.*, xxx, 510.	M., 4	Do.	Hydatid cyst of liver.	3 months.	Hydronephrosis.	—	R.
25	9. vi. '82.	Cullingworth (Manchester). *Brit. Med. Jour.*, 1882, ii, 930.	F., 36	Do.	Left hydronephrosis.	6 years.	Death from collapse in 12 hours after operation, hydronephrosis weighing 5 lbs.	D.	—

26	10. viii. '82.	Keeling (Sheffield). *Brit. Med. Jour.*, 1882, ii.	F., 23	Abdominal.	Ovarian tumour.	3 years.	Cystic tumour under the capsule of the kidney.	—	R.
27	16. ix. '82.	Goodell (Philadelphia). *Lancet*, 1883, i.	F., 52	Do.	Left ovarian cyst.	1 year.	Cyst of the kidney.	—	R.
28	20. iv. '83.	Walter (Manchester). *Brit. Med. Jour.*, 1883, ii, 615.	F., 42	Do.		3 months.	Hydronephrosis containing 10 ounces of pale straw coloured fluid.	—	R.
29	17. xi. '84.	Bardenheuer. (Private.)	M., 29	Lumbar.	Hydronephrosis.	—	Punctured previously.	—	R.
30	1884.	Coe (New York). *N. Y. Med. Rec.*, 1884, ii, 697.	F.	Abdominal.	Right hydronephrosis.	—	Died eighth day from peritonitis; urine contained albumen and tube casts.	D.	—
31	18. iii. '84.	Lloyd (Birmingham). *Birm. Med. Rev.*, xx, 270.	M., 27	Lumbar.	Intermittent hydronephrosis.	19 years.	Kidney enormously dilated; cause of obstruction to ureter not found.	—	R.
32	29. xi. '84.	Tait (Birmingham). Rep. by Taylor, Birmingham.	F., 16	Do.	Acute hydronephrosis.	—	Nephrotomy performed in 1883, followed by urinary fistula.	—	R.
33	i. '85.	Mayo Robson (Leeds). (Private.)	F., 57	Abdominal.	Abdominal cyst.	6 months.	Stenosis of ureter and dilatation of kidney into large cyst. Death from acute mania.	D.	—

NEPHRECTOMIES FOR HYDRONEPHROSIS AND CYSTIC DISEASE, &c.—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
34	11. iii. '85.	Badenheuer. (Private.)	F., 52	Abdominal.	Ovarian cyst.	—	Chronic hydronephrosis. Death from shock.	D.	—
35	30. v. '85.	Lloyd (Birmingham). (*loc. cit.*)	M., 5	Lumbar.	Intermittent hydronephrosis, left.	Congenital.	Enormous distention of pelvis and kidney tissue: choking of ureter caused by flexion.	—	R.
36	15. ix. '85.	Park (Buffalo). U.S. *Bos. Med. Surg. Jour.*, 13. v. '86.	2 years.	Abdominal.	Fibro-cystic tumour of right kidney.	—	Diagnosis confirmed; tumour weighed 4 lbs.	—	R.
37	10. x. '85.	Bergmann (Von). *Berlin. Klin. Woch.*, xlvii, 1885.	F., 48	Lumbar.	Hydronephrosis of left kidney.	—	Kidney normal; obliteration of ureter.	—	R.
38	1885.	Rupprecht. *Cent. f. Chir.*, v, 1886.	M., 5	Do.	Hydronephrosis of right kidney.	—	Cystic kidney.	—	R.
39	1885.	Watson. *Ann. des Mal. des Organes Gén-urinaires*, 1886, p. 225.	M., 22	Do.	Hydronephrosis of left kidney.	—	Enlargement and disorganisation of kidney; collapse.	D.	—
40	1885.	Bergmann (Von). *Berlin. Klin. Woch.*, xlvi, 1885.	F., 38	Abdominal.	Large cystic left kidney; supposed to be cancerous and floating.	—	Death from suppression of urine; uræmia; right kidney also cystic.	D.	—

41	18. v. '86.	Owen (London). (Private.)	F., 44	Abdominal.	Cystic disease.	10 years.	Cystic disease, chronic suppuration; renal tissue entirely destroyed; cysts contained 10 oz. thick light green pus.	—	R.
42	16. vi. '86.	Lloyd (Birmingham). (*loc. cit.*)	M., 11 mos.	Lumbar.	Intermittent hydronephrosis.	—	Obstruction from flexion of ureter. Death on fourth day. *Post-mortem* failed to show cause.	D.	—
43	—	Thornton. *Trans. Path. Soc. Lond.*, xxxvi.	F., 32	Abdominal.	Hydronephrosis.	—	Hydronephrosis due to papilloma size of pea.	—	R.
44	—	Thornton. *Trans. Path. Soc. Lond.*, xxxvi.	F., 35	Langenbuch's.	Do.	—	Hydronephrosis; no cause discovered.	—	R.
45	16. vi. '86.	Nicaise. (Brodeur.)	F., 28	Lumbar.	Hydronephrosis of right kidney.	—	Nephrotomy previously performed, leaving urinary fistula.	—	R.
46	19. vi. '87.	Elder. *Lancet*, 1887, ii, 66.	F., 23	Do.	Hydronephrosis.	—	Previously tapped; fistula remained.	—	R.

NEPHRECTOMIES FOR HYDRONEPHROSIS AND CYSTIC DISEASE, &c.—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
34	14. iii. '85.	Badenheuer. (Private.)	F., 52	Abdominal.	Ovarian cyst.	—	Chronic hydronephrosis. Death from shock.	D.	—
35	30. v. '85.	Lloyd (Birmingham). (*loc. cit.*)	M., 5	Lumbar.	Intermittent hydronephrosis, left.	Congenital.	Enormous distention of pelvis and kidney tissue; choking of ureter caused by flexion.	—	R.
36	15. ix. '85.	Park (Buffalo), U.S. *Bos. Med. Surg. Jour.*, 13, v, '86.	2 years.	Abdominal.	Fibro-cystic tumour of right kidney.	—	Diagnosis confirmed; tumour weighed 4 lbs.	—	R.
37	10. x. '85.	Bergmann (Von). *Berlin. Klin. Woch.*, xlvii, 1885.	F., 48	Lumbar.	Hydronephrosis of left kidney.	—	Kidney normal; obliteration of ureter.	—	R.
38	1885.	Rupprecht. *Cent. f. Chir.*, v, 1886.	M., 5	Do.	Hydronephrosis of right kidney.	—	Cystic kidney.	—	R.
39	1885.	Watson. *Ann. des Mal. des Organes Gén-urinaires*, 1886, p. 225.	M., 22	Do.	Hydronephrosis of left kidney.	—	Enlargement and disorganisation of kidney; collapse.	D.	—
40	1885.	Bergmann (Von). *Berlin. Klin. Woch.*, xlvi, 1885.	F., 38	Abdominal.	Large cystic left kidney; supposed to be cancerous and floating.	—	Death from suppression of urine; uræmia; right kidney also cystic.	D.	—

41	18. v. '86.	Owen (London). (Private.)	F., 44	Abdominal.	Cystic disease.	10 years.	Cystic disease, chronic suppuration; renal tissue entirely destroyed; cysts contained 10 oz. thick light green pus.	—	R.
42	16. vi. '86.	Lloyd (Birmingham). (*loc. cit.*)	M., 11 mos.	Lumbar.	Intermittent hydronephrosis.	—	Obstruction from flexion of ureter Death on fourth day. *Post-mortem* failed to show cause.	D.	—
43	—	Thornton. *Trans. Path. Soc. Lond.*, xxxvi.	F., 32	Abdominal.	Hydronephrosis.	—	Hydronephrosis due to papilloma size of pea.	—	R.
44	—	Thornton. *Trans. Path. Soc. Lond.*, xxxvi.	F., 35	Langenbuch's.	Do.	—	Hydronephrosis; no cause discovered.	—	R.
45	16. vi. '86.	Nicaise. (Brodeur.)	F., 28	Lumbar.	Hydronephrosis of right kidney.	—	Nephrotomy previously performed, leaving urinary fistula.	—	R.
46	19. vi. '87.	Elder. *Lancet*, 1887, ii, 68.	F., 23	Do.	Hydronephrosis.	—	Previously tapped; fistula remained.	—	R.

LECTURE IV.

Suppurative Disease of the Kidney. Etiology, pathology, and mode of termination discussed and illustrated by cases and specimens under the following heads:—(1) Pyelitis, simple and calculous. (2) Classification, causes, mode of origin, structure, and composition of renal calculi; the changes concretions produce upon the kidney. (3) Pyonephrosis. (4) Pyelonephritis. (5) Purulent interstitial nephritis. (6) Suppuration from foreign body. (7) Perinephritic abscess. Symptomatology, diagnosis, and prognosis considered according as the disease is unassociated or is associated with renal swelling:—(1) Pyelitis, pyelonephritis, suppurative nephritis; (2) pyonephrosis and perinephritic abscess. Symptomatology, diagnosis, and prognosis of renal calculus. Treatment of various suppurative diseases of the kidney and of renal calculus.

GENTLEMEN,—In last lecture we had under consideration those diseases of the kidney associated with an accumulation of fluid in the pelvis, in the substance of or around the organ, and I indicated to you that the fluid which so congregates may either be inflammatory or non-inflammatory. In that lecture our attention was limited to the non-inflammatory accumulations, such as hydronephrosis, cystic degeneration, and hydatid disease. To-day, and in next lecture, I will discuss with you the lesions of the kidney associated with the accumulation of inflammatory material.

Suppurative diseases of the kidney amenable to surgical treatment may be classified either according to their cause, or according to the parts primarily involved. Various terms are now employed to designate the precise situation of the lesion. When the mucous membrane of the pelvis is attacked, without any distention of that cavity, the disease is named pyelitis; while, if pus accumulates as the mechanical result of obstruction, the condition is referred to as pyonephrosis. Again, should the inflammation extend beyond the pelvis, and attack the renal substance, forming in it independent accumulations of pus, the condition is designated pyelonephritis. Occasionally an acute suppurative inflammation of the renal substance may occur without any affection of the pelvis or ureter; to this condition we limit the term suppurative nephritis. In other instances, abscesses may form in the tissue immediately surrounding the kidney, and these are called perinephritic abscesses. These conditions may be discussed together, and this I propose to do in the present lecture, and at our next meeting I will ask your attention to specific inflammations—including tubercular and syphilitic lesions.

Pyelitis is not common as a primary disease, being more frequently associated with other renal affections or a vesical lesion, especially septic inflammation of the lower urinary tract. When, as a consequence of stricture or of paralysis, the urinary bladder is incompletely emptied, there is a danger of the retained contents being contaminated by infective material introduced from without. Once introduced the micro-organisms multiply and rapidly spread in all directions, causing changes in the composition of the urine, and in the structure of the mucous membrane and walls of the bladder. The mode of extension from the bladder to the kidneys I will allude to presently.

The micro-organisms are usually micrococci; but filamentous fungi and bacilli may also be found in the urine and in the lining membrane of the urinary tract.

Here we have a specimen of interest, bearing upon the subject. You observe in this jar a number of small gelatinous masses. These were passed by a patient, whom I have at present under observation, sent to me by Dr. Sewell, of Helensburgh. I shall not trouble you with a detailed history of the case, which was clearly one of renal calculus. The point of interest at present is the nature of certain masses passed through the right ureter, which presented the appearance of bleached blood clots, and were in consistency a little firmer than calf's foot jelly. They varied considerably in size, the largest being about half an inch long, and in diameter about the size of a No. 10 catheter. These masses pass down the right ureter at irregular intervals, and are associated with the symptoms of renal colic and transitory hydronephrosis. After a few hours' suffering the patient experiences a sudden relief, and at the same time he is conscious, as he describes it himself, "of a distinct popping of something into the bladder," and almost immediately afterwards he evacuates a considerable quantity of urine, containing one or more of these little gelatinous masses. On microscopic examination the masses are found to be composed of rod-shaped bacilli, with a few crystals of oxalate of lime entangled among them.

There was no evidence of cystitis, nor was there an undue tendency to decomposition of the urine after evacuation. When passed, the urine had an acid reaction, and was free from evidence of decomposition. These bacilli, while they caused changes in the mucous membrane, did not appear to act upon the urine.

Not only do the organisms which I have mentioned cause pyelitis, but it is now recognised that the infective matter of gonorrhœa may excite an ascending inflammation in the ureters and pelves.

As an accompaniment of pyæmia, enteric fever, scarlatina, small-pox, measles, cholera, acute nephritis, or diphtheria, inflammation may attack the renal pelvis, and may be described according to its nature, as catarrhal, fibrinous, or diphtheritic. But while the last mentioned variety is not uncommonly met with in the bladder and pelvis, it rarely attacks the ureters to such an extent as to cause the formation of a false membrane.

In catarrhal inflammation, if the lesion be an acute one, the lining membrane is red and swollen, and, when very severe, hæmorrhages may occur on the mucous surface, or into the submucous tissue. When more chronic, the mucous membrane is covered with a thick purulent secretion, its walls are indurated and thickened, or should the pyelitis be due to specific irritation, limited or extensive ulceration may take place.

Pyelitis may also be caused by irritating poisons such as turpentine, cantharides, or other stimulating diuretics, or, on the other hand, inflammation may be induced by the presence of retained blood clot.

I have now enumerated to you the most important causes of non-calculous pyelitis, but these, even taken collectively, rarely lead to inflammation when contrasted with those cases which owe their origin to the presence of some direct mechanical irritant such as concretions, either in the form of small brittle masses, or larger compact stones. But while in most instances concretions are the cause of pyelitis, in not a few inflammation of the renal pelvis is the starting point for the development of a calculus.

Perhaps this is the most convenient opportunity for saying a few words respecting the mode of origin and nature of renal calculi. These bodies may be classified according to their composition. Dickinson divides them into two classes, according as they are primary or secondary deposits. Amongst the former are calculi formed of uric acid, the urates of soda and ammonia, oxalate of lime, carbonate of lime, cystine, xanthine, and indigo, whilst amongst the latter are those composed of mixed phosphates, phosphates of ammonia and magnesia, and carbonate of lime.

In order to give you a general idea of the relative frequency of the two classes just mentioned, and of the composition of the different kinds of calculous material, I have collected, in a table, the results of an inquiry into the composition of the *renal* and *vesical urinary calculi*, in the Museums of the Glasgow Royal and Western Infirmaries.

	Glasgow Royal Infirmary.	Glasgow Western Infirmary.	Total.
Oxalate of lime,	7	5	12
Uric acid,	13	13	26
Phosphatic,	18	14	32
Cystine,	...	1	1
Uric acid and phosphates,	40	21	61
,, urate of ammonia,	2	1	3
,, oxalate of lime,	16	5	21
,, urates and phosphates,	1	...	1
,, oxalate of lime and phosphates,	27	5	32
Oxalate of lime and phosphates,	8	11	19
	132	76	208

This table gives the composition of 208 renal and vesical calculi. Of these 71 were composed of only one substance, while 137 were composed of two or more. Of the simple calculi, those of uniform composition, 32 were composed of phosphates, 26 of uric acid, 12 of oxalate of lime, and

1 of cystine. Of the compound calculi, those composed of two or more materials, 118 had as one of their constituents uric acid, while 19 were composed of oxalate of lime and phosphates. Taking the simple and compound calculi collectively, it will be seen that out of the total 208, 144 contained uric acid. This result differs materially from that shown by Dickinson to be the composition of *renal* calculi as found in the Pathological Museums of London, as shown in the following abstract of his table:—

ABSTRACT OF TABLE SHOWING FREQUENCY WITH WHICH EACH SUBSTANCE OCCURRED IN SIMPLE AND COMPOUND RENAL CALCULI IN THE PATHOLOGICAL MUSEUMS OF LONDON.

	91 Calculi.	52 Simple.	39 Compound.
Uric acid occurred in . .	40 ,,	21 ,,	19 ,,
Urates occurred in . .	24 ,,	3 ,,	21 ,,
Oxalate of lime occurred in .	36 ,,	11 ,,	25 ,,
Phosphate of lime occurred in	16 ,,	3 ,,	13 ,,
Phosphate of ammonia and magnesia occurred in .	7 ,,	2 ,,	5 ,,
Mixed phosphate occurred in	20 ,,	9 ,,	11 ,,
Carbonate of lime occurred in	8 ,,	1 ,,	7 ,,
Cystine occurred in . .	2 ,,	2 ,,	0 ,,

In the table which I have compiled, showing the composition of calculi as found in the Pathological Museums of Glasgow, only 12 simple calculi are found to be composed entirely of oxalate of lime, while 72 compound calculi contain it either in combination with uric acid or phosphates. In 53 of these, the nucleus was formed of uric acid.

Dr. Vandyke Carter has shown, in his interesting work on the structure and formation of urinary calculi, that of 62 *vesical* calculi, collected in India, the nucleus was composed of urates and oxalate of lime in 34 instances, of oxalates alone in 31 instances, and of uric acid only in 7.

With these remarks on the general composition and relative frequency of the various forms of calculi, we now pass to consider how these concretions are formed.

The exact point of origin of the earliest traces of renal calculi is not easily determined. Perhaps the simplest mode of demonstrating to you the formation of calculi is to show you specimens where foreign bodies have been permitted to remain in the bladder for some time, causing decomposition of the urine, and a ready deposition of urinary sediments upon their surface. I hold in my hand two calculi, in one the nucleus is a piece of slate pencil around which an incrustation of phosphate has occurred, in the other, a phosphatic calculus, weighing 378 grains, has formed around a small piece of wood. In these instances the foreign body was introduced into the bladder, and inducing inflammation of the mucous membrane, caused it to secrete a quantity of alkaline fluid, which precipitated the earthy phosphates around the foreign body. In the same way blood clot may form the nucleus of the stone, but instead of causing a precipitation of earthy phosphate, such non-irritating substances as mucus, fibrine, and blood clot, cause only a precipitation and aggregation of the normal constituents of the urine.

This specimen from the Western Infirmary Museum illustrates what I am now saying. The bulk of the stone, which weighs two ounces, is composed of uric acid. In the centre there is an irregular disintegrated mass which, on microscopic examination, was found to be shrivelled blood corpuscles; and here is another specimen from the same collection (Professor Buchanan's). It is white externally and not nodulated. On section, the bulk of the stone is brown, and gives the reaction of oxalates. In the centre is a small cavity in which a clot was found.

Externally there is a rind, less than one-eighth of an inch in thickness, composed of phosphate of lime.

Urinary calculi are simply the aggregation of solid substances, some of which are normal, others abnormal ingredients of the urine. These powdery sediments are the starting point of the formation of gravel and of stone in the kidney. At one time it was attempted to explain the tendency to the formation of stone in certain individuals, by supposing that a particular diathesis predisposed to their production. Consequently we have a uric acid diathesis, an oxalic acid diathesis, a phosphatic, and a cystic diathesis. No one will deny that the elimination of an increased quantity of uric acid may lead to the formation of a calculus. On the other hand, it is a well established fact that even when a diminished amount of uric acid is being eliminated calculi may form. Consequently, it is incorrect to affirm that uric acid concretions are invariably due to constitutional causes. The term diathesis seems to me to be used principally to hide ignorance. Why, for example, should we say that an individual has a phosphatic diathesis, knowing, as we do, that the deposition of phosphates is the direct result of decomposition of the urine, induced by local catarrh of the urinary passages, and not by a peculiar constitutional condition of the individual? The constitutional disturbance, which you recognise as being commonly associated with the evacuation of alkaline urine, and called the phosphatic diathesis, is the result, not the cause of the vesical irritation. Again, is it not the case also that the deposition of oxalate of lime may be readily induced by certain articles of diet?

Calculi are not simply crystals deposited from the urine, their chemical constituents are bound together by some cement substance composed of organic matter. Scharling believes that the nuclei of calculi are bound together or enveloped by mucus, albumen, or other organic matter, which entangles the chemical constituents and determines their form of crystallisation. This view has been supported by Ord, who believes with Scharling that the intervention of a colloidal substance is necessary to the formation of calculi. Dr. Hoskins discovered that the delicate web of animal matter, which is found as a component part of calculi, bore a remarkable resemblance to epithelial scales. He also frequently detected, in the middle of calculi, masses of vesical and renal epithelium and tube casts.

Comparatively little is known respecting the predisposing causes of renal calculus. It may be stated, however, that renal stones are observed to occur with considerable frequency during the earlier years of life; concretions being found with tolerable frequency in the renal pelves and calices of young children below the age of five years. It is before the age of fifteen, and after the age of fifty, that calculus is most apt to occur; during the age of maturity the tendency diminishes. Again, in the lower classes, calculus is most frequently met with during the period of youth, whilst among the upper classes it occurs oftener in persons past middle life. Both of these circumstances may be explained by faults in the digestion (using the term in its widest sense), or by some deficiency in the energy of the kidney. The children of the poor are frequently fed upon coarse indigestible food, and their parents being only able to provide a limited quantity of milk, the consequence is that their bodies are not supplied with watery constituents in sufficient quantity to carry off the effete products without a certain danger of deposition of solid matter. Amongst aged persons in the better classes the occurrence of calculus may be explained by the inactive life, together with rich nitrogenous diet. Beverages as well as food may have an influence in the causation of stones. In the districts of Germany where sour young wine is drunk in large quantities, urinary concretions are comparatively common, and in England, in the Eastern counties where beer is largely consumed, renal calculi are more frequent than in those localities where gin, whisky, or brandy are preferred as beverages. Certain districts have a remarkable immunity from calculus, both renal and vesical. In Ireland it is comparatively rare, but whether this is due to the use of whisky instead of beer, or to the large comsumpt of the potato, which is so rich in alkali and poor in nitrogenous matter, it is difficult to determine.

If you suppose that the liability to the formation of calculi stands in a direct relationship to the proportion of solid constituents in the urine, then it is natural to infer that renal calculi should be more frequently met with in warm climates, where the skin is active and the urine concentrated, than in cold countries where the secretion of urine is more abundant. This has not been proven to be the case, and, as far as is known at present, climate does not appear to exercise much influence one way or the other.

Calculi formed during early life have usually nuclei of urate of ammonia, whereas those developed in adult life or in old age have uric acid or oxalate of lime as their nucleus; but while this is so in respect to calculi, deposits of uric acid may occur in the kidneys of new-born children, and form what have been called uric acid infarctions. These deposits have been explained by Virchow, who regards their occurrence to be due to the increased physiological metamorphosis of tissue which takes place as a consequence of the establishment of the processes of digestion, respiration, and heat production. In adults similar depositions occur, and it is not uncommon to find within the uriniferous tubules of the pyramids deposits of urate of soda, uric acid, or fibrinous coagula loaded with amorphous or crystalline deposits.

I have placed under the microscope specimens illustrating this condition. In one you will observe a number of cysts containing fibrinous material, rich in urate of ammonia and uric acid, and it is not improbable that the cysts which you see were caused by infarctions of the tubules by urates, uric acids, or lime salts. When the aggregation of insoluble particles reaches a certain size such as that of a pin-head, or a barley-corn, the condition is commonly described by the term renal sand, and if the concretions are still larger, they are called renal stones or calculi. Many of these calculi may be found in the kidney separated from one another by tracts of more or less altered renal tissue. They may increase in size, *in situ*, or having passed into the pelvis, there undergo considerable enlargement. Concretions may attain considerable dimensions, and mould themselves into the shape of the pelvis and calices, so as ultimately to form almost a complete cast of the cavity of the kidney; hence the largest stones are undoubtedly found within the pelves, or within the cavities communicating with them. Stones of moderate size may also form within the renal substance, or in pouches which have no connection with the urinary tract. In this specimen you have a kidney containing a calculus the size of a cherry, without any communication between the cyst containing the calculus and the renal pelvis. But while this is a very rare condition, it is not uncommon to find a calculus which has originated in one of the calices, come ultimately to be practically shut off from the general cavity of the pelvis, only a narrow communication being left.

The size, shape, weight, and appearance of the surface of calculi vary greatly. The oxalate of lime stone is of a dark bluish, yellow, or greenish colour, heavy, and very irregular on the surface. The uric acid stone is usually smooth, of a brownish-yellow colour, and rounded, while calculi composed of phosphates and carbonates are irregular in form, light in weight, soft and chalky.

We now proceed to consider the changes produced in the kidney, the renal pelvis, and the ureter, as the consequence of the presence of a renal calculus. A stone may form, travel from the pelvis to the bladder, and escape without giving rise to any symptoms; these are, however, usually small smooth stones, which pass readily into and along the ureter. If a calculus attains moderate dimensions, it is liable to obstruct the outlet of the pelvis, and hindering the escape of urine, lead either to atrophy of kidney, hydronephrosis, or pyonephrosis.

We have already discussed the pathology of hydronephrosis, and I have indicated to you how complete obstruction to the ureter may produce rapid atrophy of the kidney. The calculus when regular in form, and not fixed in position, may lead to more or less inflammation of the pelvis, characterised by thickening and induration of the mucous membrane, and not infrequently by ulceration, the formation of pus, and occasional hæmorrhages. The mucous membrane of the pelvis is not so easily excited to inflammation as that of the bladder, nor is renal calculus so liable to be associated with putrefactive changes in the urine, or the secretion of large quantities of mucus. The inflammatory process, however, readily produces grave structural alterations in the renal parenchyma, evinced by swelling, and more or less acute interstitial changes, which may terminate either in suppuration or fibroid induration. This may all occur without the ureter having been seriously obstructed. When the calculus becomes wedged in the ureter or in the exit of the pelvis, extreme distention may take place, pyonephrosis being thereby superimposed upon the pyelitis. The impacted stone may be pressed down the ureter by the fluid accumulation, and ultimately escape; or it may cause more or less complete and permanent obstruction. In the latter circumstance the pelvis gradually becomes stretched in the same way as in hydronephrosis, but with this important difference that in pyonephrosis the structural alterations in the renal parenchyma proceed more rapidly than in hydronephrosis, are associated with greater constitutional disturbance, and with graver dangers to the life of the patient, both directly and indirectly. The calculus, for example, may produce acute inflammation of the pelvis, and giving rise to hæmorrhage, erosion, and ulceration may ultimately cause rupture of the ureter or pelvis. Thereby the contents of the pyonephrosis may escape into surrounding parts, such as the cellular tissue around the kidney, the intestine, or the bladder, while in more chronic cases the kidney may form extensive adhesion to the neighbouring structures, and a sac, composed of little more than fibrous tissue, may be all that represents the lost organ.

Pyonephrosis as a consequence of stone is usually chronic, and is associated with pyuria and hæmaturia extending over a considerable period. A calculus may form in the pelvis or in one of the calices and may remain fixed, so that very little irritation results, but if the stone be free within the pelvis inflammation is set up, and considerable quantities of pus may escape at one time, while at others the purulent deposit may be almost entirely absent from the urine. When the calculus becomes impacted in the ureter, atrophy of the kidney advances with much greater rapidity than when the obstruction is associated with a non-inflammatory lesion.

Frequently a fluid accumulation, free from suppuration, is converted into an inflammatory one by injury, or by the introduction of infective material. To enumerate the causes of pyonephrosis would be simply to repeat what I have already said regarding those of hydronephrosis. There are, however, some points of difference worthy of attention, the most conspicuous being the fact that, whereas hydronephrosis pure and simple seldom is a consequence of calculus, pyonephrosis very commonly is the direct effect of the impaction of a stone; so much so indeed that for practical purposes pyonephrosis is conveniently divided into two kinds, the calculous and non-calculous. Another notable feature in the etiology of pyonephrosis is that it is often the consequence of septic inflammation or of pyelitis. Other causes of the disease which may be mentioned are tubercular disease of the kidney, extending from the lower urinary tract, which in its progress excites pyelitis, and inflammation of the ureter; and, as a consequence of the accompanying induration of the mucous membrane, the duct leading from the kidney becomes partially obstructed. Malignant disease of neighbouring organs may also produce suppuration and obstruction. It is also said that pyelitis or pyonephrosis may occur in the course of acute Bright's disease in diphtheria and other zymotic diseases.

Gradually as dilatation occurs, a process of absorption of the renal tissue is induced, and in advanced cases the whole kidney is converted into a large loculated pouch, the calices being represented by the septa, while the medullary and cortical substance completely disappear. The sac so formed may contain purulent urine, pus, or pus mixed with blood, or the fluid constituents may become absorbed, so that only a chalky or putty-like material is left.

The two specimens which I have here illustrate very well the gradual drying up of the fluid of pyonephrosis. In this first preparation the kidney is converted into a series of cysts mostly of large dimensions; some are filled with serum, others with a sero-purulent material; those containing pus present a distinct granulated internal lining. The pelvis is obliterated, and the ureter stops short of its entrance into the pelvis. In this case you have an example of a kidney in which comparatively little absorption of fluid has taken place. In the second specimen, on the other hand, the kidney has become completely disorganised, and converted into a series of cavities containing firm pultaceous material. The cysts vary in size from that of a hazel nut to that of a small orange, and are separated from one another by thin walls formed of connective tissue. The septa between the cavities are considerably thinner than the external walls, and on microscopic examination the former, as well as the latter, present the appearance of much atrophied renal tissue, which has become infiltrated with cells presenting various stages of development, from embryonic cells to dense fibrous tissue. The putty-like material which fills the cavities, on examination is found to consist of phosphate of lime, degenerated round cells, and epithelium, intermixed with poorly formed crystals of cholestrine.

If the pyonephrosis be large in size, it may cause not only displacement of the neighbouring organs, but the pressure which it exerts may produce a localised necrosis, and perforation may occur into one of the hollow viscera, into the peritoneum, the pleura, or externally. The establishment of an external fistulous opening is the most common, and, at the same time, the most favourable result to be looked for, and is usually preceded by the formation of a perinephritic abscess.

In cases where pyelitis is a consequence of septic inflammation extending from the bladder to the ureter and pelvis, independent accumulations of pus are liable to form within the substance of the kidney, in other words, a pyelonephritis becomes established. To this diseased state various designations have been applied. Because of its frequent association with serious affections of the lower urinary tract, for which operations may be required, it has long been spoken of as the "surgical kidney," but of late objections have been justly raised by surgeons to the employment of that term, because it appears to indicate that the renal suppuration is the result of surgical procedure, whereas it is well known that the renal suppuration more frequently precedes and complicates than supervenes upon operation; and further, it must be borne in mind that other kidney diseases than pyelonephritis may follow operations upon the urethra and bladder. When we come to consider operations for renal calculus it will be seen that the principal circumstance which determines the mortality is the presence or absence of suppurative disease. The surgeon has been too indiscriminately blamed for causing a condition, due rather to his aid not having been asked at an early stage, while the kidneys were still free from disease, than to his over interference. For the purpose of avoiding the misnomer, "surgical kidney," Dickinson has proposed the term uriseptic as a description of the invariable cause of this variety of renal suppuration. It should be observed, however, that the uriseptic kidney is but one form of suppurative nephritis, namely, that in which the suppuration in the kidney is preceded by inflammation of the pelvis. In other cases the pyelitis may be the secondary, and the suppurative nephritis the primary lesion.

In discussing the question of diseases involving suppuration of the renal substance it will be most convenient to confine your attention, in the first instance, to those cases in which the disease might be described as a sepsis limited to the kidneys, and due to the absorption of products containing pathogenic micro-organisms, originating in the conducting or collecting portion of the urinary tract, or what Klebs designates parasitic nephritis.

My friend, Dr. John Lindsay Steven, in a valuable contribution to the Pathology of Suppurative Inflammation of the Kidney, published in the *Glasgow Medical Journal*, September, 1884, classifies such cases as follows:—

(1.) Where the abscesses are miliary and multiple, and this may be further subdivided according as the virus has obtained access to the organ.
  (*a.*) by the uriniferous tubules.
  (*b.*) by the lymphatic vessels.
(2.) Where the abscesses are of large size; and this may be further classified according to the cause operative in each case.
  (*a.*) impaction of calculi in pelvis.
  (*b.*) impaction of foreign bodies in the pelvis, and various injuries.
  (*c.*) suppurative disease of the lower urinary tract.

If enquiry be made respecting the diseases antecedent to pyelonephritis, it will be found that lesions producing obstruction to the flow of urine from the bladder are the most frequent cause. Hence suppurative disease of the kidney may be looked upon in many cases as the natural termination of such conditions as stricture of the urethra, diseases involving enlargement of the prostate, cystitis, vesical calculus, loss of expulsive power of the bladder from atony, either as a consequence of grave nervous lesions or from local disease. These, however, are but the remote causes. Not only is it necessary that the urine be retained, but certain morbid changes must be produced in its composition. The excretion of the kidney when preserved from external contamination either inside the body, as in hydronephrosis, or outside in a sterilised vessel, will keep for an unlimited period without undergoing any putrefactive change; but if inoculation of germs occurs, then the pent-up fluid rapidly undergoes decomposition. Hence the danger of instrumental manipulation in such cases, especially in those where the products of decomposition have no means of escape.

Here you have a typical case. The organs I now present to you were removed from the body of a man, who, after having been operated upon for stone in the bladder, died a few days ago in the Glasgow Royal Infirmary. You will observe that the bladder wall is greatly hypertrophied and saculated, the prostate is enlarged, and the ureters and pelves on both side are moderately dilated. The bladder, ureters, and pelves are the seats of acute inflammation, manifested by induration and swelling of the mucous membrane, by irregularity of surface here and there, and by superficial ulcerations and incrustations of phosphates, deposited from the alkaline urine. Some of these changes are the result of chronic disease, others are due to a recent septic process. The former may be explained by the irritation produced by the presence of the calculus, on account of which not only have the structures of the part become altered, but the power which the normal mucous membrane has to prevent the multiplication of bacteria has been diminished. In consequence of this decreased power of resistance on the part of the mucous membrane, together with the stagnation of the flow of urine, bacteria having gained an entrance, have multiplied indefinitely, and produced a severe and acute inflammation, the effects of which you now see.

Having briefly glanced at the inflammatory process in the bladder, ureters, and pelves, we may now consider the changes produced in the kidneys. In the specimen now in your hands the appearances are very characteristic. You will observe that there are evidences of acute inflammation of the pelves, the organs are enlarged, and their cavities are dilated. The capsules are adherent and thickened, while the cortex is generally, but not at all parts, diminished in bulk. The renal tissue is deeply injected with blood, and is already partly decomposed, is soft and pulpy, but friable, and on section presents a mottled and streaked appearance, which is most marked in the mammillary processes. These pale streaks, on more detailed examination, are seen to extend outwards in a radiating fashion so as to form cones, the apices of which are towards the pelvis, and in some instances the bases reach to, in others even project beyond the cortex, or become lost in a soft, irregular, pulpy, putrescent mass. On microscopic examination of such a specimen as this, the tubules of the pyramidal portion of the kidney will be found blocked by elongated colonies of micrococci, around which there is more or less intense interstitial inflammation, sometimes amounting only to a slight infiltration of leucocytes between the tubules; while, in other areas, the inflammatory changes are so advanced as to have caused complete disintegration of the renal tissue, which has come to be occupied by purulent cavities. Another point worthy of note is that in this case no micro-organisms are to be found in the blood-vessels, either arterial, capillary, or venous, consequently one is driven to the conclusion that infection must have taken place either by the lymphatics, or by the uriniferous tubules. The greater abundance of micro-organisms in the tissue of the pyramids than elsewhere supports the latter presumption. How, then, are we to explain the mode of action of the virus in such cases? The following is a passage from Dr. Lindsay Steven's paper:—

"With regard to the mode in which the virus travels to the kidney in this class of cases I think it likely that it extends along the surface and interstices of the mucous membrane of the ureter until it reaches the pelvis of the kidney, setting up a slight degree of catarrhal pyelitis. The virus then gains access to the uriniferous tubules, passes along them, settles and multiplies vigorously in various situations, and gives rise to the formation of the multiple abscesses which have already been described. That this is the probable route of the virus in this class of cases is proved by the grey and injected appearance which the mucous membrane of the pelvis and ureter often presents. In so far as the remark bears upon the class of case at present under review, I agree with Mr. Marcus Beck when he says, 'it is therefore probable that in all cases slight catarrhal pyelitis precedes the decomposition of the urine in the pelvis of the kidney; but as soon as the decomposition occurs the pyelitis becomes greatly intensified by the irritation of the ammoniacal urine.' I cannot altogether coincide with him, however, in the opinion 'that in consequence of the irritation to which the pelvis and ureters are exposed in common with the kidney, from the obstruction to the free passage of the urine, a slight degree of inflammation is set up,' because I believe that in a large number of the cases there is no obstruction to the passage of urine, and even if there was, I do not think that it *per se* is able to give rise to inflammation, especially an inflammation which may lead to suppurative nephritis. It will generally be found that the starting point of such conditions takes place after organisms have had an opportunity of passing into the genito-urinary system from without, as the result of catheterism or other surgical interference with the bladder or urethra."

When, as in the case just described, the renal pelvis is primarily attacked, and the accumulations of pus within the renal substance are clearly secondary, it is natural to assume that the pathogenic micro-organisms, having entered the uriniferous tubules from the pelvis, undergo a process of multiplication, and forming colonies, obstruct the lumen of the tubules, impair the vitality of the epithelium and basement membrane, which ultimately ruptures and allows the inflammatory products to pass into the intertubular lymphatic spaces, where they rapidly excite diffuse inflammation. This explanation of the course of events may be sufficient for some cases of pyelonephritis, but what are we to say of those instances of inflammation of the lower urinary tract in which a suppurative nephritis is induced without the renal pelvis being involved, or only implicated to a very slight degree? In order that you may appreciate the pathology of this subject it will be necessary for me to make a few remarks respecting the lymphatic supply of the bladder, ureters, and kidneys. While conducting a series of experiments some years ago, I noticed that when an injecting mass was forced into the ureter, occasionally it found its way into the renal substance, and, on further investigation, I ascertained that the lymphatic vessels of the cortex and medulla might be very completely injected through the lymphatic channels surrounding the ureter. The course which the lymphatics pursue from the bladder, is one of direct distribution along the connective tissue surrounding the ureters to the capsule of the kidney. They then penetrate the renal substance, and lie in spaces between the uriniferous tubules, so that, when in a kidney thus infected a section is made of the cortex, the lymphatic vessels can be easily seen, extending in thin streaks from the extreme cortex towards the medulla, and becoming paler in colour as they pass from without inwards. This method of injecting the lymphatics shows very clearly that there is a communication between the lymphatics around the ureter and those supplying the renal substance. These experiments have been repeated by my late assistant, Dr. H. Lyon Smith, and by Dr. J. Lindsay Steven.

The following very interesting case came under my observation a few years ago. The clinical history may be epitomised by saying that the case was one of stricture of the urethra of old standing, associated, within the last eighteen months of life, with symptoms of chronic Bright's disease, namely albuminuria, occasional œdema of the feet, dyspnœa, evidences of increased arterial tension, and hypertrophy and dilatation of the heart, &c., &c. Ten days before death patient complained of pain over the left kidney, ushered in and accompanied by rigors, elevation of temperature, frequent and painful micturition, and abundant pyuria.

The *post-mortem* examination revealed aortic valvular disease; hypertrophy and dilatation of left ventricle; dilatation of mitral orifice, brown induration of the lung; nutmeg liver; enlargement of the spleen; stricture of the urethra; ulceration of the bladder and pelvis of the left kidney; multiple miliary abscesses of the left kidney.

With special reference to the condition of the urinary organs, the following remarks may be made:—There is a firm stricture of the urethra in the membranous portion, through which a No. 4 catheter can be passed. The muscular walls of the bladder are hypertrophied, and the viscus contains about 15 ounces of putrid urine. The mucous surface is covered by a greyish-yellow filament which, when removed, reveals the presence of extensive ulceration. The ulcers are very irregular in form with elevated edges, and their floors are coarsely granular. On laying open the ureters from the bladder to the pelves of the kidneys, the right ureter is found to be practically normal, while the left is contracted, and its walls thickened and indurated, but there is no trace of either old or recent ulceration. The right kidney and its pelvis are normal. The pelvis of the left kidney is studded over with small ulcers, varying from the size of a split pea to that of a barleycorn. The edges are level with the surface, while the floors of the ulcers are only slightly depressed, and covered by what appear to be recent granulations. This ulcerative process is strictly limited to the pelvis, and does not extend into the calices of the kidney, the larger ulcers being situated at its inferior extremity. The kidney is slightly enlarged, soft, pale in colour, the surface is smooth, and the capsule is easily separated. Immediately under the capsule a number of small pale bodies are seen, the majority of which are not larger than mustard seeds. On section, the cortex and medulla are seen to retain their normal proportions, and the line of separation is tolerably distinct.

On microscopic examination, the muscular wall of the bladder is found to be increased in bulk, and the fasciculi are separated from one another by bands of fibrous tissue. The serous surface presents nothing worthy of note; but on the mucous surface there are distinct areas of acute inflammation, the inflammatory products containing large numbers of micrococci. A section of the ureter about two inches from the pelvis of the kidney shows the mucous membrane to be practically normal in appearance, but the deeper structures are infiltrated with round cells containing micrococci. In the pelvis of the kidney are very similar appearances to those seen in the bladder. On examination of the kidney, the small pale bodies are found to be minute abscesses, evidently of very recent origin. They are most abundant underneath the capsule, and although some of them are found in the cortex close to the medulla, in this region they are less abundant. None of these bodies are found in the pyramidal portion. The abscesses are also loaded with micrococci similar to those found in the lower urinary tracts.

The examination of this case leads me to the opinion that the progress of the infection was from the lower to the higher regions of the urinary tract. It seems to me abundantly evident that the lesions found in the bladder were of older standing than those in the wall of the ureter and pelvis of the kidney, and also that the line of transmission was not along the mucous surface, but in the deeper structures of the ureter, probably along the course of the lymphatics. The fact that the calices of the kidney and the medullary portion were not involved in the inflammatory changes seems also to indicate that the infective process did not extend through these regions, while, if we are to admit that the lymphatics extend from the pelvis of the kidney to the sub-capsular lymphatic spaces, it is only a natural inference to suppose that the substance of the kidney became infected through those channels. When it is borne in mind that the abscesses in the kidney are more abundant in the extreme cortex than in its deeper areas, this explanation becomes all the more acceptable.

Pyelonephritis may be excited by many causes independently of obstruction to the evacuation of urine. The most important of these is renal calculus. Calculous pyelitis is one of the most frequent causes of renal abscess, and even although the calculus is not within the pelvis, having originated in a renal tubule, or become shut off from the cavity of the kidney by inflammatory adhesions, it may cause sufficient irritation to produce severe inflammation and suppuration. When considering the changes produced in the kidney, the renal pelvis, and the ureter as a consequence of renal calculus, I merely glanced at secondary lesions in the kidney, and occupied your attention mostly by those cases in which the abscess cavity is formed for the most part by the dilated pelvis. In other instances the abscess is developed within the substance of the organ, and may, for a considerable period, have no communication with the pelvis. The presence of a foreign body in the renal tissue mechanically irritates it, and induces more or less suppuration. In some instances, as in the specimen in my hand, the amount of inflammation is slight, and, as you will observe, the calculus is closely surrounded by kidney tissue. When the stone is freely movable, purulent nephritis is more apt to develop, and, ever increasing, may ultimately cause softening and purulent degeneration of the entire kidney, so that in the end little or no trace of the organ is left but a sac of fibrous tissue filled with pus and calculi. While these changes have been taking place in the substance of the kidney, around the organ extensive adhesions have been forming with neighbouring organs, or the acute inflammatory process may extend to the perinephritic tissue, and ultimately rupture may occur externally, or into one of the hollow viscera. Many cases have been recorded in which the pus and calculi have escaped by an opening in the loin, while a few will be found in which the abscess discharged into the peritoneum, stomach, intestine, pleura, or bronchial tubes, or opened upon the hip, in front of the thigh, or in the groin.

Respecting the mode of death in cases of renal calculus, which have proceeded to their natural termination, I am unable to present you with any definite statistics, but from what I can learn from an inquiry into the literature of the subject, I can with confidence assert, that of persons who die from the effects of renal calculus, in the great majority the immediate cause of death is suppuration of the renal pelvis or of the substance of the kidney. On the other hand, chronic renal or extra-renal suppuration can induce amyloid or other organic disease of the kidney on the opposite side, or be the focus of general disseminated pyæmia. Calculus may also terminate the life of the patient by inducing suppression of urine and uræmia.

A distinction must be drawn between purulent nephritis, associated with suppurative disease of the bladder, ureters, and pelvis (pyelonephritis), and similar lesions of the kidneys, without pre-existing disease of the conducting and collecting portions of the urinary tract (suppurative interstitial nephritis.) The etiology and pathology of the former condition I have already fully discussed. Respecting the latter I have still a few words to say.

Purulent interstitial nephritis may arise from many causes, in most of which it is possible to recognise the presence of pathogenic micro-organisms. In certain zymotic diseases, and diseases associated with the presence of specific organisms, metastatic abscesses may form in the kidney, as a consequence of infective embolisms. In such cases the poisonous material is carried by means of the circulating blood, and consequently analogous lesions are usually found in the lungs, liver, brain, &c., but in a few instances suppuration may be limited to the genito-urinary passages. Long ago Cruveilhier, Reverdin, and Verneuil showed that in patients who died from anthrax the kidneys presented grave lesions, due to infective emboli, which we now know to be formed principally by the specific micro-organisms of the disease. In a similar manner acute suppurative disease of the kidney has been found to follow osteomyelitis, a disease which has been demonstrated by Pasteur, Klebs, and Max Schüller to be of an infective nature; and Ribbert and Rodel, by a carefully concluded series of inoculation experiments, have shown the wonderful rapidity with which multiple suppurating foci are developed in this disease. Multiple renal abscesses have also been known to result from the absorption of the virus in erysipelas and other suppurative lesions of the skin and subcutaneous tissues, or in the course of such diseases as typhus fever, enteric, small-pox, septic pleurisy, &c.

I have here a preparation from the Royal Infirmary Museum showing metastatic abscesses in the kidney. On the surface were seen numerous small elevations; these were minute abscesses into which hæmorrhage had occurred. On section they were seen to exist in every part of the renal tissue, but especially in the cortical region. These deposits were present in great abundance in both kidneys, their size averaging that of a pin head. Similar deposits were found in almost every part of the body. On the skin there were hæmorrhagic spots, and the remains of what had been observed during life as an extensive crop of pustules; on the surface of the pia mater there were hæmorrhagic and purulent spots; in the heart there was a softened patch about an inch in length and three-eighths in breadth; in both lungs numerous metastatic deposits, some hæmorrhagic and some purulent; in the pleuræ, soft lymph; in the spleen also metastatic deposits; and in the intestines similar deposits in remarkable abundance appearing like berries in some of the blood-vessels. In the right knee there was some brownish fluid, and a few minute abscesses in the muscles of the thigh, but no pus in the femoral vein.

There was in this case no external wound detected either before or after death, and the chief complaint during life was of the right knee.

The case is reported in *Glasgow Medical Journal*, November, 1870.

In pyæmia generally both kidneys are affected, the organs being enlarged and elastic. The capsule is easily separated, and between it and the cortex there may be numerous small hæmorrhages, in each of which there is a small yellow spot. These are the miliary abscesses, with their surrounding hyperæmia. The abscesses project slightly beyond the surface of the kidney, as small round miliary prominences, some of a deep red colour, others white or yellow, surrounded by a deep zone of injected vessels, and on account of the anatomical arrangement of the renal vessels, the suppurating areas are more abundant in the cortex than elsewhere. The contents of the smaller abscesses are composed of disintegrated fatty glandular tissue, mixed with pus, and in the centre of these collections of inflammatory products colonies of micrococci are seen. These microscopic bodies sometimes only involve a glomerulus or a minute vessel, while at the same time the inflammatory process extends to the surrounding tissue, in a similar manner to what has been already described as the mode of extension of inflammation from the uriniferous tubules in cases of pyelonephritis. On examining a section made from the cortex to the pyramids, the inflammatory process will be seen to follow the distribution of the renal arterioles, and, when large in size, to assume the form of a cone with the base towards the periphery of the kidney. When a section is made of these larger abscesses, their contents escape and leave a ragged cavity. The contents are soft and pulpy, and on careful examination will be found to be impregnated with micrococci, while the walls will be observed to be composed of leucocytes and red blood corpuscles, which have infiltrated the renal tissue. Whether the infection be due to pyæmia, malignant endocarditis, or other infective disease, the pathology of the renal lesion is very much the same. Primarily the lesion is embolic, but it is more than a simple obstruction to the circulation. Being derived from a part where putrefactive inflammatory changes are going on, the embolus possesses infective properties; so that, in addition to plugging of the renal arterioles, it sets up inflammatory processes both in the vessel within which it has become impacted, and also in the surrounding renal tissue, which terminates in suppuration and destruction of the infected area. The connection between septic nephritis and the primary lesion has been carefully studied by a considerable number of investigators, amongst whom I may mention Davaine, Colin, Tedenat, Charrin, Barrette, Coze, Feltz, and Steven.

In place of originating a large number of minute and widely scattered abscesses, the embolus may obstruct one large vessel, and lead to a suppuration of considerable size, but limited to one organ. Mayer has reported, in *Virchow's Archiv*, a case in which a large embolus became impacted in the right renal artery, and produced a large abscess, in the pus of which numerous bacteria were found.

I have shown you the various modes of infection which may ultimately lead to renal abscess. I mentioned first infection from the pelvis and ureter by the uriniferous tubules, and by way of the lymphatics, and I have now illustrated how poisonous material may be conveyed to the kidney by the blood stream, and have pointed out the effects produced in the kidney by these agencies.

Excluding now abscess of an infective nature, it may be said that primary renal suppuration is very rare. The most common cause is external violence, such as wounds, contusions, lacerations of the kidney, and the presence of foreign bodies. Traumatism as a cause of abscess will be referred to in a subsequent lecture, so that it is unnecessary to allude further to it now. I have, however, a specimen, which, before we pass from this subject, I desire to bring under your notice. The preparation was placed in the Western Infirmary Museum by Dr. Steven, who showed the specimen at the Glasgow Pathological and Clinical Society, at their meeting, 8th January, 1884. It was obtained from the body of a man who died from injury to the head, with laceration of the brain, &c. The patient died soon after admission, so that nothing is known as to the history of the renal condition during life. The suppuration of the kidney was due to a very uncommon cause—namely, the impaction of a foreign body in the pelvis. As you will observe, the substance of the right kidney, except at its lowermost part, is occupied by large cavities which, in the recent state, were filled with creamy pus. Lying in the long diameter of the pelvis of the organ there is a thick coarse bristle, to the lower extremity of which a branched calculus, composed of phosphate of lime, is attached. The ureter is slightly dilated, and the calculus extends into one of the calices. The bladder was found to be normal, but contained, after death, a small quantity of purulent urine. Left kidney normal.

This specimen is one of special interest, as it is a unique example of a foreign body introduced into the bladder, making its way up the ureter to the kidney, and there setting up suppurative inflammatory changes, and giving origin to the formation of a calculus.

That the action of drugs and poisons may produce pyelitis, or even a catarrhal inflammation of the kidney, I am willing to admit; but I gravely question if it has been proved that it induces suppurative inflammation, and should be classed amongst the causes of renal abscess. The cases recorded are so few in number, and of such a doubtful nature, that in the meantime it is perhaps safer to leave them out of consideration.

During the course of this lecture I have frequently had occasion to refer to perinephritis and perinephritic abscess consecutive to such diseases of the kidney as renal calculus, suppurative pyelitis, pyonephrosis, pyelonephritis, or suppurative interstitial nephritis. At a subsequent lecture I shall have occasion to show you that these diseases may also be due to tuberculosis, non-inflammatory neoplasms, or injury. In the following observations, therefore, my remarks respecting the origin of perinephritic abscess will be limited to those instances in which the disease develops independently of the causes I have just mentioned: in other words, arises as a primary lesion, or as a consequence of inflammation extending to the tissue around the kidney from distant parts.

You will remember that, when speaking of the etiology of movable kidney, I described to you the relationship of the kidney to its surroundings, and mentioned in particular the anatomical distinction between the fibrous and the adipose capsules (p. 18). Inflammatory changes in the former are not in themselves of much importance. It is otherwise when the loose mass of adipose tissue surrounding the kidney is attacked, situated as it is in direct contact with the easily infiltrated connective tissue of the retroperitoneal and pelvic spaces. That the connective tissue surrounding the kidney is prone to suppuration has long ago been recognised, but Rayer was the first writer who gave a clear and elaborate description of perinephritis; after him valuable contributions to the subject were made by Féron, Parmentier, Lemoine, Hallé, Guerin, Trousseau, Krætschmar, Duffin, and Dickinson. From statistics collected by some of these authors it appears that perinephritic abscess is most frequently caused by inflammation extending from within the kidney tissue, and it is shown only in a few instances that suppurative perinephritis originates from other causes.

This is not only true of general pyæmia, but the statement is even more applicable to localised infective processes. For example, not only has the disease been traced to septic infection in febrile conditions—such as typhus, enteric fever, and variola—but it has also been shown to arise from purulent absorption in cases of inflammation of the connective tissue surrounding the uterus, vagina, or rectum, succeeding parturition or an operation. Trousseau recorded a case in which the perinephritis was of uterine origin, and where he believed the inflammation to have extended by way of the iliac veins. In cases of puerperal perinephritis, which is by no means uncommon as a complication of pelvic cellulitis, an abscess frequently develops in the neighbourhood of the ovaries or Fallopian tubes, and, gradually dissecting its way, ultimately spreads itself out between the lumbar muscles and the peritoneum. Operations upon the testicle, or upon the spermatic cord, are very liable to excite inflammation of the connective tissue surrounding the bladder, especially at its base, from whence suppuration may extend to the peri-renal connective tissue. Cases are upon record in which the disease I am now speaking of succeeded operations upon the testicle, urinary bladder, and urethra, or formed a sequence to conditions such as hydrocele, varicocele, or hæmatocele. In a similar manner operation upon the perinæum, rectum, and uterus, or suppurative disease of the gall bladder, liver, and spleen, have caused the accumulation of pus around the kidney.

Koenig narrates a case of excision of the rectum in which the suppuration extended upwards from the pelvic cellular tissue, along the posterior wall of the rectum to the peri-renal adipose tissue of the left kidney, and spread itself out as far as the descending colon.

I have here a very interesting specimen from the Western Infirmary Museum, in which a perinephritic abscess not only perforated the ascending colon, but also communicated with the ureter on the opposite side.

"The kidney, which is the left, was completely surrounded by an abscess of complicated shape which communicated externally. The kidney itself is converted into a series of irregular cavities, which contained pus. The pelvis of the kidney is greatly shrunken, and hardly recognisable; but a cavity, in its position, communicates with an aperture in the ascending colon, through which a piece of whale-bone has been passed. The abscess was also in communication with the ureter of this side, and with the opposite ureter by an elongated branch of the abscess which crossed the middle line. The right kidney was enlarged, and the seat of numerous small abscesses. The liver and spleen were highly amyloid. The right testicle was the seat of tubercular disease.

"The patient was a man aged 30, who had been in the hospital twice at an interval of two years. There had been a severe injury to the testicle, with urethral suppuration six years before; but it was on the opposite side from the renal abscess. At first there was a somewhat acute nephric or perinephric abscess, with a very large tumour in the region of the left kidney, and with pus in the urine; which subsided apparently by discharge into the intestinal canal; the renal tumour being no longer perceptible after two to three months, although pus was still present in the urine. He recovered sufficiently to leave, although there was presumptive evidence of amyloid disease. He was re-admitted fifteen months afterwards with large re-accumulation of the abscess, which was opened antiseptically. After a time albuminuria, anasarca, &c., supervened, but it was only about a fortnight before death that pus returned to the urine."

I have shown you how easily inflammatory processes, beginning in the neighbouring organs, may extend by continuity to the remarkably loose peri-renal connective tissue which offers every facility to the rapid extension of suppuration. In a few cases, which have been regarded as examples of primary perinephritic abscess, it is difficult to explain the occurrence of the disease, there being no evidence of the mode of infection. Steven, in the paper to which I have already had occasion to refer, suggests the following explanation. He says, in respect to such cases:—"The abscess may often appear to be strictly limited to the region of the kidney, without any very distinct relationship to disease in any neighbouring part, continuous with it. In reference to some of these the facts which have already been described with regard to the lymphatics of the ureter and kidney may often offer a reasonable explanation. The virus may have originated in the bladder, and spread up by means of the lymphatics of the ureter to the capsule of the kidney and its surrounding connective tissue. It may then set up abscesses in this situation, which tend to limit themselves to the neighbourhood of the kidney rather than to extend in upon the organ itself. Thus a perinephric abscess may originate which apparently has no relationship whatever to any other part. I do not say that this explanation will suffice for all cases of apparently idiopathic perinephric abscess, but I believe that it will at least explain a certain number of them."

When pus has newly formed in the peri-renal connective tissue it is usually limited by a more or less definite abscess wall; during this period the swelling is rounded and smooth. The collection of pus does not long remain confined, but spreads in the directions of least resistance and assumes a very irregular form. It, however, usually retains its position behind the peritoneum, and from that situation may infiltrate the neighbouring muscles—psoas, iliacus, and quadratus lumborum, or may burrow along the lumbar, pelvic, or crural fasciæ. Most commonly peri-renal abscesses extend backwards and outwards, and open in the lumbar region. While this process is going on, the kidney, which is as a rule situated in front, is pressed forwards so as to occupy a position between the abscess and the peritoneal cavity, into which, as a result, perinephritic abscesses rarely rupture. But should such an accident occur, acute and fatal peritonitis is set up. While, in the majority of cases, the abscess, by a destructive process, makes a channel for itself through the lumbar muscles, &c., in other instances, the pus is confined by the fasciæ, and consequently its mode of extension is limited to the direction in which it meets with least resistance. In this way it may extend along the psoas muscle to a point in the inguinal region; it may reach the gluteal region by the sacro-sciatic foramen, or by following the course of the blood-vessels the pus may appear in front of the thigh. In place of extending in a downward direction it may pass upwards, along the dorsal muscles behind the diaphragm to the root of the lungs, and, dissecting its way into the posterior mediastinum, may rupture into one of the bronchi, discharge itself by expectoration, or set up a purulent pneumonia. In other instances the pus has found its way into the pleural cavity and produced an empyema. Another and more common mode of exit is by one of the hollow abdominal viscera. According to the side occupied by the abscess it may perforate the ascending or descending colon, or make its way into the vagina, the bladder, through the prostate into the urethra; or the pus may escape by the small intestine or stomach.

I have now fully discussed with you the etiology, pathology, and modes of termination of the non-specific inflammatory affections of the kidney likely to require the aid of the surgeon. These points I have considered in a definite order, but now that we come to the question of symptomatology and diagnosis perhaps it would be well to depart to some extent from this systematic arrangement of the subject, and endeavour rather to indicate the symptoms and physical signs by which the presence of the various diseased conditions may be discovered. This is all the more desirable seeing that the various lesions which I have brought under your notice in this lecture may be but different phases of disease in an individual case.

The leading facts in respect to the *symptoms* of the various forms of suppurative disease of the kidney have been involved in the remarks I have already made in this lecture, and, at the second meeting of this course, I endeavoured to sketch out to you the general symptomatology of renal diseases in the treatment of which the surgeon's aid may be required. I then showed you the points to be attended to in making a differential diagnosis of the sources of hæmorrhage in hæmaturia, and indicated the significance of pyuria, and the distinguishing character of pain and swelling in the renal region. In doing so I eliminated the less important and least significant features of the diseases, and aimed rather at giving you a general idea of diagnosis. It therefore only remains for me to remark more in detail upon the diagnosis of the various forms of suppurative disease from one another, or, in some cases, rather upon the circumstances which distinguish the different phases of one disease.

Let us first understand what points are to be made out, and afterwards consider how a diagnosis is to be arrived at. I may remind you of the various conditions to be distinguished from one another. The simplest form of suppurative renal disease is uncomplicated pyelitis. Again, inflammation of the renal pelvis may be associated with calculus (calculous pyelitis), or with distention of that cavity (pyonephrosis), which also may be complicated by calculus (calculous pyonephrosis). On the other hand the inflammation may extend from the pelvis to the substance of the kidney (pyelonephritis), and to its surface (perinephritis), or a suppurative inflammation of the kidney may arise without previous disease of the renal pelvis (suppurative nephritis).

These suppurative lesions may be divided into two classes, according as they are unassociated or associated with renal swelling. For example, in simple pyelitis, pyelo-nephritis, and suppurative nephritis, any considerable swelling in the lumbar region is rare, whereas in pyonephrosis and perinephritic abscess it is a characteristic feature of the disease. We shall therefore consider first the diagnosis of suppurative diseases unassociated with renal swelling, then proceed to contrast the symptoms of pyonephrosis and perinephritic abscess, and, finally, discuss the diagnosis of renal calculus in the various situations it may occupy.

We begin with the diseases unassociated with swelling in the renal region—namely, pyelitis, pyelonephritis, and suppurative nephritis. In considering the diagnosis of these affections I will do so independently of the individual causes of the lesion, as these frequently mask the secondary affection; but, while doing so, I at the same time desire to impress upon you the necessity of including in your diagnosis not only the renal lesion, but also the conditions which have given rise to it.

Pyelitis, especially when it is of the catarrhal form, is usually easily distinguished from pyelonephritis and suppurative nephritis; but when it is associated with retention and rapid decomposition of urine the diagnosis is very difficult, sometimes impossible. In uncomplicated cases of catarrhal pyelitis, pain of a dull dragging kind, increased on pressure, is complained of, in the course of the ureter, in the lumbar region, and occasionally extending downwards to the bladder; it is seldom severe, and may often be absent for considerable periods. Attacks of pain may be accompanied by elevation of temperature; but, as a rule, the fever is not marked, when present is generally transitory, and is sometimes coincident with the appearance of a cutaneous eruption resembling German measles. There is not, however, in pyelitis that yellowish-grey tint observed in pyæmic diseases. The fever is usually nocturnal, and is in proportion to the severity of the disease.

The condition of the urine constitutes the most prominent and characteristic indication of disease of the renal pelvis. During the acute stage the quantity of mucus in the urine is increased, and at the beginning or during the course of the case there may be slight hæmaturia. Throughout there is persistent and slowly increasing, but seldom abundant, pyuria, and the pus, which has not any unpleasant smell, deposits readily from the acid urine in which it is suspended. The amount of free acid contained in the urine, as evacuated from the bladder, varies from time to time. This may be due to two causes—either the alkaline reaction of the urine from the diseased kidney is variable, or the normal acid reaction of the urine secreted by the healthy kidney is inconstant, although it is usually more than sufficient to neutralise the alkaline secretion from the diseased gland. So long as this is the case micturition is not unduly frequent, even although the urine may have an offensive odour, and may contain partially dissolved crystals of triple phosphates, which doubtlessly formed in the alkaline urine of the diseased organ. If there be any tendency to frequent or considerable accumulation of urine in the renal pelvis, the retained fluid is liable to undergo decomposition, and so resemble the urine in cystitis. In the urine, from cases of suspected pyelitis, it is necessary to make the examination as soon as possible after micturition.

In addition to pus and a few blood corpuscles, the urine generally contains epithelium. It is of great importance to determine the character and, if possible, the site of origin of these cells. Attempts have been made to distinguish between loose epithelium cells detached from the pelvis, ureters, and bladder, in the same way as it was sought at one time to distinguish individual cancer cells as distinct from other cells of epithelial origin. In most books on the subject, descriptions and illustrations are given of epithelium from the various parts of the urinary tract and from the vagina. Referring to the diagnosis of pyelitis without tumour, Roberts says:—"In the first stage of the complaint the presence of the characteristic epithelium of the pelvis and calices in the urinary deposit generally suffices to indicate the nature of the disease. When the urine has become purulent, these may still be found mixed with the pus corpuscles; but in more advanced cases this valuable sign is no longer available, and the source of the discharged pus must be traced by other indications." This view of the localisation of the disease by the urinary deposit has been controverted by Dickinson, who has endeavoured to ascertain how far the epithelium from each part of the tract can be distinguished. By obtaining epithelium from the various parts in succession, he found that in the healthy subject the renal epithelium can be readily recognised, but that the cells from the renal pelvis are not distinguishable from those of the ureter, and that cells separated from the bladder were club-shaped, fusiform, and not distinguishable from those belonging to the pelvis and ureter.

With these observations my own concur. If it is impossible to distinguish epithelium removed in the healthy subject from the pelvis and ureter, as contrasted with that from the bladder, how much more difficult must it be to derive reliable information when these structures are the seat of disease. In desquamative catarrh of a mucous surface, the epithelial cells are shed in large numbers and mingle with the secretion. From what has been written by some observers, one would be led to the conclusion that they believed that this process of separation was all that happened to the epithelial cells, and that these were thrown off from the mucous surface in much the same form as they presented during health. This is not so. When a mucous membrane is inflamed the epithelium becomes granular, undergoes a process of softening, so that the cells are capable of taking on the most varied forms and of throwing out prolongations. This is most marked when the superficial cells are rapidly thrown off, and being replaced quickly by means of regenerative multiplication of the deeper cells. Hence the catarrhal secretion may contain epithelium in all stages of development—from round cells, resembling pus corpuscles, to caudate cells similar in appearance to those described as being characteristic of exudation from the renal plevis. I do not deny that, for example in vesical catarrh, groups of tessellated epithelial cells of circular form are sometimes significant, and that in pyelitis, flattened, laminated, caudate epithelial cells may be often more abundantly present in the urine than when the renal pelvis is not involved in the inflammation, but what I desire to convince you of is that the diagnostic significance of individual loose cells is of no more value than is the observation of single epithelial cells removed from a tumour. To diagnose pyelitis from the appearance of the cells in the urine is no more justifiable than the diagnosis of a cancer from a few isolated cells detached from a growth. If the mucous membrane was shed in small shreds or in casts, with the epithelium adhering, then the microscope might aid us; but when the histological relationships of the cells are lost, so also is their significance.

When, as a complication of the retention of decomposing urine, or as a sequence to a chronic pyelitis, the inflammatory process extends from the pelvis to the substance of the kidney, the course of the disease is usually very rapid, and the diagnosis is not difficult. The history of some obstruction to the flow of urine is usually found,—whether it be from stricture of the urethra, enlarged prostate, atony of the bladder, vesical calculus, tumours of the bladder, tuberculosis, disease of the spine, or other cause by which the bladder is kept in a distended state, and its contents rendered liable to decomposition.

When decomposition of urine in the pelvis of the kidney occurs, pyelonephritis soon manifests itself, sometimes, but not usually, by severe pain in the loins, aggravated by pressure upon the abdominal walls over the kidney. Although pain in the renal region is rare, the patient suffers from spasm at the neck of the bladder, and pain along the tract of the ureter. These symptoms are accompanied by high fever, ushered in by rigors. The patient has an anxious expression, the skin is flushed at first, but soon becomes pale yellow or even jaundiced, the pulse is rapid and feeble, the mouth is dry, the tongue coated, and becomes fissured and crusted, the patient complains greatly of thirst, and appetite is lost. There may be slight fulness in the region of the kidney, and although micturition is frequent, the urine eliminated is small in amount. The other symptoms are headache, vomiting, hiccough, diarrhœa, profuse sweating, somnolence, sopor, and low delirium; which may be complicated by evidences of pulmonary œdema, erysipelas, dropsy, or perinephritic abscess, but seldom accompanied by convulsions. Towards the termination the skin becomes moist, cold, and clammy, and death is usually anticipated a few hours by profound coma.

The urine does not present any characters of diagnostic value, but varies much according to the individual case. When the inflammation primarily involves the pelvis, and has spread rapidly from it to the kidney tissue, the urine, although purulent, remains acid for some time, and is less abundant than normal. The urine may, however, present the characters indicative of chronic Bright's disease, namely, polyuria and albuminuria, with diminution in the quantity of urea and the presence of tube casts.

Pyelonephritis is usually the result of an unhealthy state of the bladder. Consequently in that disease the urine, although it may be acid when it escapes from the ureter, becoming mixed with the contents of the bladder, decomposes, is passed alkaline, has an offensive odour, and contains a large quantity of mucus, epithelium, pus, and triple phosphates. When there are no acute or chronic organic changes in the kidney, the quantity of albumen is regulated by the amount of pus or blood; but, as not infrequently chronic Bright's disease also exists, there is an albuminuria independent of these constituents, so that no relationship exists between the amount of pus or blood and the quantity of albumen.

The diagnosis of pyelonephritis from suppurative nephritis must rest largely upon a careful consideration of the etiological facts of the case. The constitutional symptoms of the two diseases are practically the same. In the former, however, pyuria precedes; in the latter it succeeds the other symptoms. If the abscess in the kidney ruptures externally, or forms a perinephritic abscess throughout the course of the case, pus may not appear in the urine; but should the abscess attain a considerable size, and rupture into the pelvis, ureter, or bladder, the sudden appearance of a large quantity of pus in the urine may clear up the diagnosis.

Before passing to the consideration of the suppurative diseases of the kidney, with swelling in the renal region, I may say a word or two respecting the probable duration and termination of pyelitis, pyelonephritis, and suppurative nephritis.

The course and duration of the disease first mentioned must be considered in connection with its cause. In simple cases of catarrhal pyelitis, generally the symptoms only last for a short time; the inflammation subsides, the pus disappears from the urine, and the termination is favourable. Pyelitis is not commonly a primary disease, and very frequently it is due to causes which are not easily removed. A calculus can be extracted; but, if allowed to remain, may keep up irritation for an indefinite period, especially when the lesion is unilateral. When the cause is of such a nature as to induce bilateral pyelitis, the case must always be looked upon as grave. It is stated by medical writers that, as an accompaniment of enteric fever, scarlatina, small-pox, and measles, the inflammation usually disappears when convalescence sets in; while as a complication of acute nephritis, cholera, and diphtheria, it must be looked upon as a very unfavourable indication.

Simple pyelitis may lead, as a consequence of prolonged and more or less profuse suppuration, to amyloid infiltration of the kidneys or of other organs, or may become complicated by chronic interstitial nephritis, which by slow degrees ultimately causes death. It is otherwise when the inflammation of the pelvis is associated with grave vesical changes, causing retention and decomposition of urine. Then pyonephrosis, pyelonephritis, or suppurative nephritis may supervene with all their dangers and complications. Should one or other of the two latter diseases become established, the course towards a fatal termination is usually very rapid; but it may be here remarked that these diseases, although they present a very high mortality, do not invariably end in death.

It is not necessary for me to tell you how death may be brought about in such diseases as those we are now considering, as I have already, while discussing their morbid anatomy, shown you the course they are likely to follow, nor do you require to be reminded that when the disease is unilateral its prognosis is comparatively favourable, for while one kidney may become completely destroyed the other may hypertrophy and perform a double task.

I have now concluded what I have to say respecting the diagnosis and prognosis of suppurative diseases of the kidney usually unassociated with renal swelling. We have still to study the symptomatology of pyonephrosis and perinephritic abscess as distinguished from these diseases and from one another.

At last lecture and the one preceding it, we discussed fully the diagnosis of hydronephrosis, and in this lecture I have described to you the symptoms of pyelitis. In pyonephrosis you have practically the symptoms of these two diseases combined—namely, evidence both of suppuration and obstruction. In some cases suppuration precedes the obstruction, in others the opposite sequence of events occurs, as when a hydronephrosis becomes inflamed, while, in a third class, the two conditions develop *pari passu.*

In pyonephrosis there is a characteristic renal swelling, elastic, fluctuant, and varying in size, from time to time, much in the same way as in hydronephrosis. Together with these symptoms, there is a discharge of pus in the urine, or evidence of its retention, manifested by increase in the renal swelling, and more severe pain in the lumbar region, which is aggravated by pressure in front, but relieved by pressure from behind. There may be also symptoms of a more urgent nature, indicative of systemic poisoning, either from non-elimination of the urinary constituents, or from absorption of infective material.

In pyonephrosis the quantity of pus in the urine varies from day to day, according to the posture the patient occupies, and to the nature of the obstruction. The changes in the condition of the urine are determined by the same circumstances as those noticed in cases of pyelitis and pyelonephritis. If not otherwise manifest, the diagnosis between hydronephrosis and pyonephrosis is easily determined by an exploratory puncture, and the latter disease may be distinguished from perinephritic abscess by the absence of marked fever, or of any increase in the local temperature, œdema, and redness.

The symptoms and diagnosis of perinephritic abscess now come under our consideration. The former may be inferred from the description I gave you of the morbid appearances. In the early stage of the disease the diagnosis is often very difficult, but when it has developed the physical signs are sufficiently distinctive to lead one to a correct diagnosis.

During the course of this lecture I have frequently had occasion to refer to conditions which may terminate in the formation of a peri-renal abscess, either as a consequence of an extension of inflammation outwards from within the kidney, or by the peri-renal connective tissue becoming involved by direct infection from an inflammatory focus in a neighbouring organ or part. Occurring, as it does, under very diverse circumstances, and as a consequence of causes differing in many respects from one another, it is not surprising that the symptoms vary, and the diagnosis in some cases is extremely difficult. In cases where the primary disease is an acute one, a perinephritic abscess may develop without having been suspected, and even in chronic cases errors may be made, the disease being supposed to be lumbar or psoas abscess, hip joint disease, or caries of the spine.

In most cases, the symptoms of perinephritic abscess are sufficiently characteristic. The history of the case having shown the existence of one or other of the causes of perinephritic abscess, we find on enquiry that the patient complains of a deep-seated, severe, lacerating pain in the lumbar region, which is increased by pressure in the loin or on movements of the patient. The pain is accompanied or followed by the appearance of a doughy swelling in the renal region, which fills up the lumbar hollow, and causes a sense of fulness on palpation. This general swelling is at first ill defined, but by and bye the inflammation becomes more limited and fluctuation can be detected. Later in the course of the case, the abscess may again become diffused. On the appearance of swelling, the skin in the loin becomes red, waxy, and œdematous, and about the same time, or even earlier, there are evidences of grave constitutional disturbance, as shown by continuous elevation of temperature, with evening exacerbations, general ill health, emaciation, loss of appetite, occasional rigors and sweating, gastric disturbance, and all the other concomitants of extensive suppurative disease.

In perinephritic abscess the swelling in the renal region differs from that observed in hydronephrosis, pyonephrosis, tumours of the kidney, cystic degeneration, and echinococcus, in that the fluid accumulation pushes its way backwards in the lumbar region rather than forward towards the peritoneal cavity. Persistent elevation of temperature is also strongly in favour of perinephritic abscess as distinguished from the diseases I have just mentioned. On account of the close contact which the peri-renal connective tissue has with the psoas muscle the position which the patient assumes in bed may suggest the existence of a psoas abscess. In many cases the patient assumes the supine posture, but if the inflammation comes to involve the lumbar plexus of nerves, the irritation may give rise to severe pain, extending down the thigh and across the hip and back, causing inability to extend the thigh, and producing a lameness, associated with a rotation inwards of the thigh, and a peculiar bent forward position while standing, together with an inclination of the body to the affected side. The position which I have just described is doubtless assumed by the patient for the purpose of relieving the pressure upon the abscess contents.

This symptom is one of considerable value, and according to Nieden's statistics was observed in 27 out of 166 tabulated cases. In some cases all motions of the hip, with the exception of extension, are free from pain, and the patient lies in comfort when the thigh is flexed, while, in other instances, the thigh is firmly drawn up on the abdomen, and any attempt even at passive movement, or the effort of the patient to turn in bed brings on severe pain.

The urine in perinephritic abscess does not present any characters of diagnostic value. When the peri-renal inflammation is due to causes external to the urinary organs, the excretion is high in specific gravity, acid, and, as a rule, non-albuminous, and does not contain blood, pus, or tube-casts. But if the temperature be high, a trace of albumen may be detected, or, on the other hand, if the pressure of the abscess is sufficient to seriously impede the exit of blood from the kidney, albumen, blood, or even blood casts may be detected in the urine as a consequence of the passive hyperæmia so induced.

When the abscess is the result of bruises or laceration of the kidney, hæmaturia and pyuria may be prominent symptoms, and when the inflammation of the peri-renal connective tissue is the consequence of pre-existing renal or vesical disease, the urine, being altered from the normal by the primary affection, fails to aid the diagnosis.

The diseases with which perinephritic abscess is most apt to be confused are lumbago, neuralgia of the kidney, renal tumours, especially cancer, cystic degeneration, hydronephrosis, pyonephrosis, perityphlitic abscess, caries of the spine, coxitis, and psoitis. To consider the differential diagnosis of all these diseases in detail is quite beyond the province of this course of lectures. Those who desire to inquire further into this matter, I must refer to a paper by Neiden in *Deutsch. Arch. für Klin. Med.*, band. xxii, 1878; and another by J. B. Roberts, of Philadelphia, in the *Amer. Jour. Science*, new series, vol. lxxxv, 1883.

In considering the probable duration and termination of pyonephrosis and perinephritic abscess little now requires to be added to what I have said under the etiology and pathology of these diseases. In many cases the beginning is very insidious, and the progress of the disease slow, so that while attention is being devoted to concomitant and consecutive phenomena, the pyonephrosis or perinephritic abscess is liable to escape observation. In cases of pyonephrosis, as in those of hydronephrosis, the duration of life depends largely upon whether the disease is bilateral or unilateral, but even when it only involves the kidney on one side the dangers to life are much greater in the affection now under consideration than when the fluid accumulation is non-inflammatory. Again, the probable course of a pyonephrosis depends upon the nature of the primary disease, the degree of obstruction to which it gives rise, and the condition of the kidney on the other side. If unilateral obstruction and suppuration have gradually arisen in an otherwise healthy individual, compensatory hypertrophy of the opposite gland ensues, and the patient may incur comparatively little danger, so long as the collection is small in bulk and the urine remains acid, but when it becomes alkaline and is associated with vesical irritation the risk of grave complications is greatly increased. When the distention of the pelvis is rapid, and caused by a sudden impediment to the escape of pus, the general constitutional symptoms are more marked than in chronic cases, the fever is higher, and the danger to life is in many cases so great as to demand immediate surgical interference. It must also be evident to you that the prognosis is very unfavourable when the primary disease is of such a nature as of itself to endanger, or even necessarily involve, the life of the patient, as, for example, in cases of tubercular disease of the renal pelvis or the bladder, or malignant disease of the uterus or rectum.

Independently of its determining cause, pyonephrosis may cause death in many ways, amongst which I may simply mention—by rupture of the sac into the peritoneum or thorax, either as a consequence of injury, or spontaneously; by interfering with the function of other organs by pressure; by inducing inflammation of the renal substance or of neighbouring parts; or by producing slow and gradual exhaustion and anæmia, associated with low fever and symptoms of amyloid infiltration of various organs, and by pyæmia and septicæmia. The most favourable termination to be looked for is one which does not often happen—namely, the rupture of the pyonephrosis into some part of the conducting portion of the urinary tract. By such a result, or by the removal of the obstructing body, a spontaneous cure may be effected so long as the pyonephrosis has not been of sufficient duration to cause grave structural changes in the affected kidney. On the other hand amelioration of the symptoms may be affected by rupture of the sac, either externally, or into some portion of the alimentary canal. Should the former event occur, a permanent urinary fistula may be established in the loin, while if the latter, even though efficient drainage may be established through the bowel to which the sac is adherent, the patient constantly incurs the danger of death from acute peritonitis.

The prognosis of perinephritic abscess depends upon whether the suppuration is primary, or secondary to renal disease, to inflammation of neighbouring organs or to disease of the spine.

If primary and of recent origin, the prognosis is good in most cases should surgical treatment be resorted to at an early date. In such cases, after a thorough drain for the abscess has been established, the patient experiences great relief, and the wound heals within a comparatively short time, and leaves behind no bad results. Should the presence of pus in the peri-renal connective tissue be undiscovered, or, when detected, should it be allowed to run its course untreated, as I have already shown, the pus may burrow in various directions, and lead to a fatal termination, by rupturing ultimately into the peritoneum, pleura, or intestine.

When the perinephritic suppuration is secondary to other grave lesions in the kidney or elsewhere, the prognosis is very unfavourable in respect to both immediate and remote results. Even although some extraordinary cases have been recorded of recovery subsequent to rupture into the bronchi, or alimentary canal, in the great majority of cases where suppuration has been protracted, the patient's health has become seriously affected, and he has died without evacuation having taken place. Should, however, a fistulous opening become established, in any of the directions mentioned to you when we were studying the pathology of this disease, a long period usually elapses before the sinus heals. The length of the interval between the evacuation of the abscess and the permanent closure of the fistula depends upon the nature of the primary lesion. Not uncommonly, even when the abscess is opened artificially and a free drain established, the protracted suppuration induces amyloid disease, to which the patient succumbs. Death may also be caused in ways similar to those I mentioned as occurring in pyonephrosis and pyelonephritis.

The question of the symptomatology and diagnosis of renal calculus, as shown by the changes which it may induce in the urine, and by pain and swelling in the renal region, has already been fully discussed in the second lecture of this course. It may be necessary now to repeat some of the statements then made, but I will avoid doing so excepting in so far as it is necessary for the elucidation of our subject. In the lecture just referred to I showed you how to distinguish between hæmaturia arising from renal calculus and that due to other causes, and I also indicated to you the diagnostic value of pain and swelling. The association of swelling with the other symptoms of renal calculus is of great significance as indicating obstruction to the escape of urine, and if combined with pyuria the diagnosis points to calculous pyonephrosis. The diagnosis of renal calculus naturally separates itself into two divisions—(1) those cases in which there is calculus without suppuration, and (2) those with suppuration. And again, from a diagnostic point of view, it will be necessary to consider renal calculi in respect to their nature and situation, and as to whether the disease involves one or both kidneys.

In cases without suppuration, especially if the calculus be impacted in the renal substance, the symptoms are not marked; indeed, the only indication of disease may be occasional slight renal pains, with or without hæmaturia, or severe pain may exist for a time and then disappear for a long period.

It is in such cases that the diagnosis of renal calculus is difficult, sometimes quite impossible. You may have renal pain, frequent micturition, slight hæmaturia, or even the presence of small quantities of pus in the urine, from an undue increase in the free acid in that excretion, or from oxaluria. The habitual deposit of uric acid, or oxalate of lime, in urines of high specific gravity, is often associated with dyspeptic, nervous, and other symptoms strongly suggestive of renal calculus. These may last for long periods, but if suitable treatment be adopted they rapidly disappear.

On the other hand considerable, sometimes enormous, stones may be discovered in the kidney after death, although no renal disturbance had been known to exist at any period during the life of the patient. This is not uncommonly observed in hospital practice. Under such circumstances the want of knowledge may reasonably be attributed to the carelessness of the patient, but such an explanation cannot be urged for a case which Dickinson describes. A renal calculus, composed of phosphates of magnesia and ammonia, weighing seven and a half ounces, was taken from the body of a daughter of Sir Richard Steele, in whom, during life, no symptoms indicated its presence.

In uncomplicated cases of renal calculus the pain is generally dull, or may only amount to a sense of weight in the loin on the affected side. It is, as a rule, inconstant, absent while the patient is at rest, but aggravated on any movement of the body, but especially by jolting movements, such as jumping, riding, driving, &c. The pain may also vary with posture, one attitude being generally associated with increased discomfort, while another may bring relief. The unpleasant sensations I have just referred to are for the most part limited to the affected side, but may perhaps extend along the course of the ureter, to the perinæum, testicle, or down the thigh; but while this is so, they may pass over or even be limited to the opposite renal region. I shall have more to say respecting this symptom when we come to discuss the situation of calculi.

In non-suppurating cases of calculus, hæmaturia is one of the most important symptoms. But while, on the one hand, it may be true to state that, of all causes of hæmorrhage from the kidney, calculus is the most common, on the other hand a calculus may occupy the kidney without at any time causing the patient to lose a perceptible quantity of blood. In the second lecture of this course (page 85) I stated to you the main characteristics of calculous hæmaturia.

Although constantly present or oft repeated, hæmaturia from calculus is rarely so profuse as to cause marked anæmia. Perhaps the most characteristic feature of calculous hæmaturia, as distinguished from other forms, is its dependence upon movements of the body. Sometimes increase in the hæmorrhage does not immediately follow exercise, but only shows itself after some hours or even days. I have a case at present under observation in which increased hæmaturia almost invariably follows twelve to fourteen hours after taking exercise.

Irritation of the urinary bladder, as manifested by frequent and sometimes painful micturition, is not an uncommon accompaniment of renal calculus—so much so that I have seen this disease mistaken for cystitis, or suspected to be vesical calculus. This mistake is, however, more apt to occur when the renal stone has caused suppuration.

On account of the intimate relationship which exists between the nerve supply of the kidneys and that of the alimentary canal, renal pain, especially if intense, is accompanied by more or less gastric disturbance, varying in degree from the mildest attacks of nausea to the most violent vomiting of bilious matter, flatulence, and gastrodynia.

When the renal calculus has given rise to or is associated with suppuration, the symptoms are generally distressing and persistent. The amount of irritation in the kidney, the renal pelvis, and ureters, caused by a concretion depends largely upon its nature and situation. The rougher, heavier, and more freely movable a calculus is, the higher will be the degree of irritation, as manifested by symptoms of pyelitis or pyonephrosis superadded to those of calculus.

When we come to consider the operations for renal calculus, as contrasted with those for suppurative disease alone or combined with the presence of a concretion in the kidney, it will be evident to you that the most important factor to be taken into account is the presence of suppuration. In the statistics of operations I have divided the cases in the following manner:—1st, those of renal calculus without suppuration; 2nd, those in which renal calculus is associated with suppuration; and 3rd, suppurative disease of the kidney without calculus. As this division is a most important one, so must it also be of great practical value for the surgeon to determine previous to operating whether or not the nephrolithiasis is suppurative or non-suppurative. The distinction between these two forms of disease is not always easy, as it may be said that almost all renal calculi cause the formation of some pus, which must appear in the urine, and hence all cases of renal stones are suppurative. But while this is true in the strictest sense, and may lead to difficulty in individual cases, still for practical purposes the two phases of renal disease are clearly separable.

In suppurative cases the symptoms, superadded to those of calculus, depend upon the nature and degree of the renal inflammation. If limited to the pelvis, the complication may not, for the time being, be serious; but if the calculus causes great irritation, or comes to be impacted in the pelvis or ureter, the more serious symptoms of pyelonephritis or pyonephrosis may manifest themselves; and if the inflammation be of old standing, the perinephritic fat may become condensed, and the kidney so enlarged as to be easily felt with the hand. The symptoms of these diseases have been discussed fully in the early part of this lecture, and in the second lecture of the course (page 94) I directed your attention to the value of pain and pyuria as symptoms of calculous pyelitis.

I may, therefore, now pass to the consideration of the diagnosis of the various kinds of renal calculi from one another. This is to be done mostly by a careful examination of the urine. When the presence of the stone is complicated by pyelitis or other forms of suppurative disease of the kidney, ureter, or bladder, the differential diagnosis is extremely difficult. When uncomplicated, the diagnosis is easier. Special attention should be paid to the reaction of the urine and the nature of the sediment which is thrown down immediately after micturition. When the urine is acid, crystals of uric acid, oxalate of lime, or cystine may be thrown down at once, and so give a clear indication of the nature of the concretion. Besides microscopic deposits, small grains or minute calculi may be voided, and, falling to the bottom of the vessel, attract attention, and aid one in forming an opinion of the character of the concretions left behind.

Should, however, such evidence be wanting, other indications may be sought for. Uric acid calculi are indicated when the symptoms appear during the vigour of early life, or in individuals liable to attacks of gout. In such cases the urine is strongly acid, the precipitation of the uric acid being indeed the consequence of a decomposition of the urates by a free acid.

On the other hand, should the urine be clear and contain a large percentage of lime salts, and precipitate on standing crystals of oxalate of lime, at the same time that the patient complains of other symptoms of oxaluria, the probability is that the calculus is one composed, in part at least, of oxalate of lime. The formation of this calculus is frequently associated with a grave amount of nervous prostration, and is most often met with in those who lead studious and sedentary lives. Calculi composed of urate of soda, cystine, or xanthine are also found together with an acid condition of the urine, but their formation is so uncommon that it is not necessary to discuss them here.

In alkaline urine the calculus most commonly met with is one composed of mixed phosphates, or the centre of the calculus may be composed of a deposit from acid urine coated over with phosphates. When the entire calculus is made up of one deposit the urine is usually alkaline early in the course of the case, and remains so throughout, but when the stone is a compound one the nucleus is either composed of uric acid, oxalate of lime, or urates.

It must also be borne in mind, as I have already shown you, that crystals of triple phosphates may be deposited from urine, which possesses an acid reaction when passed. Calculi of pure calcic phosphates are rare, and seldom attain, when unmixed, any considerable size, but while the small nucleus may be formed of calcic phosphate, the bulk of the stone, which may increase greatly, is made up of mixed phosphates. Concretions of carbonate of lime are very rare, in fact, it has been held by some observers that calcic carbonate is never deposited in the form of a renal calculus, except as a secondary formation, when it is precipitated along with phosphate of lime or triple phosphates.

It may be stated in a general way that when the urine is alkaline from an increase in the amount of ammonia, there is some disease of the conducting or collecting portions of the urinary tract. Either the urine is retained in the inflamed or otherwise diseased renal pelvis, or in the bladder, where it becomes mixed with viscid, irritating mucus, undergoes rapid decomposition. The urea being converted into carbonate of ammonia, combines with the phosphates, and the insoluble triple phosphates are deposited. This deposit may, with the mucus from the renal pelvis, form a stone, or if a calculus has caused pyelitis, the triple phosphates may gradually become encrusted upon the surface of the pre-existing stone. That this change has taken place militates very much against the patient when nephro-lithotomy is required. But not only may the urine be alkaline as an indirect consequence of disease of the bladder, ureter, or pelvis, but it may be so either from an increase in the amount of fixed alkali secreted, or a diminution in the quantity of free acid eliminated. These conditions are generally associated with grave organic disease in other organs, such as chronic Bright's disease, phthisis pulmonalis, cirrhoses of the liver, diseases of the spinal cord, &c., and when present for some time they are usually followed by decomposition of the urine, and greatly increased alkalinity of that excretion.

Previous to operating it is advisable, but not always possible, to determine the situation occupied by the calculus. When the calculus is impacted in the substance of the kidney, and uncomplicated by pyelitis, comparatively little pain is suffered, but when present it is persistent rather than paroxysmal, is of a dull aching character, is generally localised in the loin, and is not associated with much hæmaturia or general disturbance. Should the cavity in the kidney be much larger than the calculus the symptoms more closely resemble those of calculus in the renal pelvis. If the stone be situated in a large cavity, or in the renal pelvis, pain becomes a marked symptom, and is no longer limited to the loin, but extends down the ureter to the testicle, to the inner aspect of the thigh, or to the leg. The pain just described is largely dependent upon movement and posture, being aggravated by exercise and relieved by rest. When a calculus becomes dislodged from one of the infundibula or from a fixed position in the pelvis, the pain is more than usually severe, occurs in paroxysms, and is generally attended by nausea, faintness, and vomiting. When a stone enters the ureter the symptoms become very distinctive. The pain presents the character which I have already described to you (page 94):—It is agonising, and radiates from the region of the kidney down the ureter, to the thigh, penis, and testicle. When the first sickness and faintness, so characteristic of renal colic, have passed off, the patient may endeavour to relieve himself by contortions in all directions, or may be thrown into convulsions by the fearful agony he is suffering. After a period of great anguish, usually measured by hours, the pain subsides as suddenly as it came on, and the other symptoms accompanying it disappear. If the calculus passes into the urinary bladder, the patient may be sensible of the fact, but if the stone has merely become displaced from the renal orifice of the ureter, another paroxysm may occur at any time. In other cases the calculus remains impacted in the ureter, which becomes more or less habituated to its presence; under such circumstances, although the pain may set in suddenly, it becomes only gradually relieved, and cessation of suffering alternates with paroxysmal attacks, probably caused by spasm of the ureter.

Suppression of the urine is another indication of the calculus having entered the ureter, or having obstructed its renal or vesical orifice. This occurs most frequently in corpulent persons between the ages of 50 and 60. Should the calculus succeed in entering the ureter, the situation where it is most liable to be arrested is close to the vesical exit, at the point where the duct enters the muscular wall of the bladder. The patient may tell you that for some time the site of the pain has been constantly shifting in a downward direction, but has now become fixed. If in addition to these indications of the situation of the stone, there should be evidence of sudden suppression of urine on one side, the diagnosis is clear. With the symptoms of suppression of urine you are already familiar.

There is a question we have still to enquire into—namely, Is the calculous disease limited to one kidney? That the pain of renal colic is felt only on one side is not sufficient to justify the conclusion that the disease is also so limited, for not only may the other organ contain calculi but the patient may ascribe the pain to the healthy side instead of to the diseased one. When the evidence in the case is in favour of the calculus being primarily phosphatic, that is to say, due to a local cause, the presumption is that the disease is unilateral; whereas if it can be shown that the stone is composed of uric acid or oxalate of lime, conditions dependent upon a constitutional state, or associated with grave disturbance of the health, there is more danger of both kidneys being involved. Again, should it be found that, during an attack of renal colic the urine evacuated from the bladder is normal, the ureter on the diseased side being completely obstructed, and no urine from it being permitted to enter the bladder, then it is certain that the opposite kidney is normal. It is seldom, however, that, as a natural sequence, the obstruction on the diseased side is transitorily so complete as to afford this means of diagnosis, but the desired information may be procured with certainty artificially by compression, or catheterisation of the ureters.

Pyelitis is so uncommon as a primary disease that its *treatment* must be considered in view of the fundamental disease of which it is but a secondary consequence. When an accompaniment of pyæmia, diphtheria, Bright's disease or a zymotic disease, the inflammation of the renal pelvis is so overshadowed by the graver malady that it seldom attracts attention; hence special therapeutic measures are not demanded. The treatment of pyelitis practically resolves itself into the treatment of its cause, which may be obstruction to the flow of urine in the urethra, bladder, or ureter, as also the presence of renal calculus, tuberculosis, parasites, tumours, &c.

At present I may say a few words in the first place respecting those cases in which the symptoms of pyelitis are the most marked feature of the case, and afterwards I will ask your indulgence while I make a few observations in regard to other instances in which the inflammation of the pelves and infundibula occurs in consequence of retention, or ammoniacal decomposition of the urine. The treatment of renal calculus, tuberculosis, parasites, tumours, &c., will be described in their proper places.

In cases of acute pyelitis treatment has two objects in view—to alleviate suffering and diminish the amount of pus. The former may be accomplished by absolute rest in the recumbent posture, and the employment of warm diluents and anodynes, especially opium. Wet cupping or the application of leeches to the loins has a marked effect in reducing both the pain and the quantity of pus and blood in the urine. If the patient is otherwise robust, twelve to sixteen ounces of blood may be removed with great advantage; but the quantity must be regulated by the circumstances of the case. I have seen the most marked improvement within a few days from this treatment.

In chronic cases the main object is to diminish the amount of pus and mucus. With this object in view, astringent remedies have been employed for the purpose of reducing the hyperæmia of the mucous membrane, and so lessening the flow of pus and the hypersecretion of the mucous glands. Metallic astringents, such as acetate of lead and the salts of iron, as well as buchu, mineral acids, vegetable astringents, alum, tincture of cantharides, carbolic acid, salicylic acid, and the balsams, have all been recommended. When the urine becomes alkaline, or when it is persistently neutral, or nearly so, nitro-hydrochloric acid, together with quinine and iron, is frequently beneficial; and if the urine becomes fœtid, according to Dickinson's experience, much good may be derived from the administration of creasote.

Should the discharge continue, it is very important to employ means to prevent the danger of pyelonephritis being established. This is best accomplished by maintaining a free exit to the urine, and seeing that the interior of the bladder is kept clean and thoroughly aseptic. If the pyelitis occurs from obstruction to the urethra, the first business of the surgeon is to enable the urine to pass freely, and so relieve the pelvis from backward pressure; and should there be any evidence of decomposition of the urine, or even undue alkaline reaction of that excretion, the bladder should be carefully washed out with an antiseptic solution, care being taken to keep the catheters scrupulously clean.

When the obstruction gives rise to a renal swelling, we have then to deal with a pyonephrosis. The treatment of this disease resembles in many respects that of hydronephrosis, which we discussed at last lecture (p. 143). The remarks I then made respecting the necessity of bearing in mind the great variety of lesions which may lead up to a dilatation of the renal pelvis are equally applicable now. Should the fluid accumulation be due to a removable cause—such as displacement of the pelvic organs or of the kidneys, tumours of the bladder, uterus, or ovaries, renal calculi, stricture of the urethra, enlarged prostate, &c.—it is the duty of the surgeon to direct his attention to the primary disease. Little requires to be said here regarding the special treatment of pyonephrosis, as it is involved in what I have still to say in connection with renal calculus, and in what I have already said respecting the treatment of hydronephrosis. Thus, in some cases of pyonephrosis good may result from manipulation; but it must be employed with great care, as evil consequences may follow undue pressure on the wall of the sac. In a few instances, also, repeated aspiration has been followed by a complete cure; but, at the same time, it is right to mention that this mode of treatment has, by introducing septic matter into the sac, been followed by serious complications.

When the disease is unilateral, and the obstruction to the escape of pus by the ureter is not complete, there being little or no pain and an absence of fever and emaciation, expectant treatment may be adopted, as in not a few such cases the pus becomes dried up and inspissated, the sac shrivels, while the kidney on the opposite side hypertrophies. But if it be observed that the renal swelling is increasing in bulk and becoming more painful, that the pus is not escaping freely with the urine, and the patient is suffering from fever, serious gastric and intestinal disturbance, rigors, sweating, loss of appetite, and emaciation, with evidence of an extension of the inflammation to the tissues around, then you have a certain indication that the intervention of the surgeon is immediately required.

In such cases free antiseptic drainage at the point of election behind should be resorted to early, on account of the danger of the pyonephrosis opening into the peritoneum. Some writers advise that no operation should be adopted with a view to evacuate the sac unless there be decided indications of pointing. Such a course is, to my mind, very injudicious, for, as I pointed out to you when discussing the pathological anatomy of fluid accumulations within the kidney, the tendency of a pyonephrosis is to extend forwards rather than backwards.

Since 1870, 49 nephrotomies have been performed for suppurative disease of the kidney independent of tubercular lesions or renal calculi (page 230).

NEPHROTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	1870.	Bryant. *Lancet*, 1870.	—	Lumbar.	Renal suppuration.	—	Suppurative disease without calculus. Death 25th day after operation from acute peritonitis.	D.	—
2	4. v. '76.	Maclaren (Carlisle). (Private.)	M., 29	Do.	Abscess in kidney.	2 years.	Diagnosis confirmed; profuse discharge for six months, followed by death.	—	R.
3	1876.	J. Marshall (London). (Private.)	M., 56	Do.	Renal abscess.	6 years.	Left kidney contained abscess; pelvis and calices dilated, and contained fibrinous concretion covered with phosphates; death in 7 weeks.	D.	—
4	24. ii. '77.	Quincke. *Revue Sc. Med.* xii, 637, 1878.	M., 34	Do.	Contusion of kidney.	?	Suppuration of kidney resulting from injury in 1860.	—	R.
5	4. v. '77.	Courvoisier. *Revue Sc. Med.*, xv, 624, 1880.	F., 24	Do.	Do.	4 years.	Kidney suppurating; general peritonitis.	D.	—
6	1877.	Lange (F.) *Ann. Surg.*, St. Louis, 1887.	F., 33	Do.	Hydronephrosis infected by gonorrhœa.	Several years.	Large pyonephrosis.	—	R.
7	viii. '78.	Post. *N. York Med. Jour.*, i, 1879.	F., 44	Do.	Suppurating kidney, left.	7 years.	Suppurating cavity in left kidney; fistula remained.	—	R.
8	1878.	Bryant. *Dickinson*, vol. iii, 990.	F., 56	Do.	Calculous pyelitis.	—	10 ounces of pus evacuated. In two months wound closed; recovery complete.	—	R.

9	2. iv. '79.	Puzey. *Lancet*, i, 1880, 213.	M., 40	Lumbar.	Suppurating kidney, right.	—	Diagnosis confirmed; death from broncho-pneumonia.	D.	—
10	xi. '79.	Macewen (Glasgow). (Private.)	M., 30	Do.	Pyonephrosis.	4 mos.	Abscess in substance of kidney; No calculus.	—	R.
11	1879.	Habershon. *Med. T. and Gaz.*, i, 1880.	M., 28	Do.	Calculous pyelitis of left kidney.	4 mos.	Kidney suppurating.	—	R.
12	v. '80.	Thornton. *Brit. Med. Jour.*, 26. v. '83.	F., 27	Puncture and drained.	Pyelitis.	10 years.	Cyst in both kidneys.	—	R.
13	7. xii. '80.	Baker. *Trans. Med. Cong.*, vol. ii, p. 262, 1880.	F., 7	Lumbar.	Suppuration from calculus.	—	No calculus found; no improvement from operation; nephrectomy subsequently performed.	—	R
14	1880.	Golding-Bird. *Lancet*, 30. x. 1880.	Boy	Do.	Renal neuralgia from calculus.	—	No calculus discovered.	—	R.
15	1880.	Waelle. *Rev. Sc. Med.*, xx, 282.	M., 20	Do.	Suppurating kidney, left.	Many years.	Diagnosis confirmed; fistula remained for	—	R.
16	15. v. '81.	Baker. *Trans. Med. Cong.*, vol. ii, 264.	M., 16	Do.	Renal calculus with pyuria.	4 years.	No calculus found; Patient recovered, but with permanent fistula.	—	R.
17	2. vii. '81.	Reliquet (Brodeur).	F., 32	Do.	Purulent hydronephrosis of left kidney.	—	Survived two years.	—	R.
18	21. x. '81.	Maclaren (Carlisle). (Private.)	F., 20	Do.	Abscess in kidney.	3 years.	Alive, August, 1886; sinus still open.	—	R.
19	xi. '81.	Golding-Bird (London). (Private.)	M., 42	Incision.	Pyonephrosis.	—	Diagnosis confirmed. Sinus remained for some time. Ultimate recovery.	—	R.
20	—	T. E. Bundy. *Boston Med. and Surg. Jour.*, 1882.	F., 31	Lumbar.	Do.	10 years.	Diagnosis confirmed; sinus remained after operation.	—	R.

NEPHROTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
21	—	A. H. Richardson. *Boston Med. and Surg. Jour.*, 1882, 106.	F., 24	Lumbar.	Do.	6 years.	Small concretion evacuated; sinus remained.	—	R.
22	1881.	John Duncan. (Private.)	F., 55	Incision.	Septic Pyelitis.	—	Kidney suppurating sac, sequel to cystitis; sinus left.	—	R.
23	vii. '82.	Leopold (Dresden). (Private).	F., 26	Lumbar.	Pyonephrosis.	2 years.	Diagnosis confirmed; death on second day from shock.	D.	—
24	2. xi. '82.	Israel. *Berl. Klin. Woch.*, xii. 1882.	F., 34	Abdominal.	Suppurating kidney, left.	From infancy.	Diagnosis confirmed; death from collapse.	D.	—
25	28. x. '83.	Wright. *Med. News*, 1884, p. 51.	M., 37	Lumbar.	Suppurating kidney, right.	—	Diagnosis confirmed; degeneration of the right kidney; left hypertrophied; obstruction of ureter.	D.	—
26	1883.	Marshall. *Med. Times*, i, 1883, 624.	F., 3	Do.	Contusion of left kidney.	—	Kidney suppurating; result of injury.	—	R.
27	2. iv. '84.	A. E. Barker (London). (Private.)	M., 48	Do.	Pyelitis.	2 years.	Right kidney not much diseased: Left quite disorganised; much relief; death 15 months after from tubercular disease.	—	R.
28	15. iv. '84.	J. C. Benton (Glasgow). (Private.)	F., 11	Do.	Pyonephrosis.	4 mos.	Abscess in posterior part of left kidney; death on 3rd day from suppression of urine.	D.	—

29	2. viii. '84.	A. T. Cabot (Boston, U.S.) (Private.)	F., 28	Lumbar.	Pyonephrosis in movable kidney.	—	Diagnosis confirmed; recovery with fistula.	—	R.
30	26. viii. 84.	F. Imlach (Liverpool). *Med. Chir. Jour.*, 1885.	F., 21	Abdominal.	Pyonephrosis.	—	Large suppurating cyst of right kidney.	—	R.
31	4. viii. '84.	Gardner. B, 508.	F.	Lumbar.	Abscess in kidney, right.	Several years.	Diagnosis confirmed; recovery complete.	—	R.
32	1. ix. '84.	S. Knaggs. *Brit. Med. Jour.*, i, 1885, 428.	F., 28	Do.	Suppurating kidney, right.	4 mos.	Diagnosis confirmed; pus continued in urine, but in smaller quantities.	—	R.
33	11. x. '84.	Neve. *Lancet*, i, 1886, 201.	M., 40	Do.	Suppurating kidney, left.	—	Diagnosis confirmed; communication between left kidney and colon; death from pulmonary congestion.	D.	—
34	ix. '84.	Gardner. *Austr. Med. Journ.*, 15. iv. 1885.	F.	Do.	Do.	—	Diagnosis confirmed.	—	R.
35	20. ii. '85.	G. Buchanan (Glasgow). (Private.)	F., 33	Do.	Pyonephrosis.	9 mos.	Abscess in lower part of kidney (right). Cause not stated.	D.	—
36	6. iii. '85.	Sadler. *Lancet*, i, 1886, 919.	M., 22	Do.	Suppurating kidney, right.	2 years.	Diagnosis confirmed; death from uræmia.	D.	—
37	15. iii. '85.	G. G. S. Taylor (Liverpool). (Private.)	M., 50	Do.	Renal abscess.	2 years.	Right renal abscess without calculus.	—	R.
38	iv. '85.	A. G. Miller (Edinburgh). (Private).	M., 19	Incision and drainage.	Pyonephrosis.	7 mos.	Diagnosis confirmed; right kidney amyloid.	—	R.
39	5. vi. '85.	Labbé (Brodeur).	F., 30	Abdominal.	Suppurating kidney, right.	—	Diagnosis confirmed; death from general peritonitis.	D.	—
40	13. vi. '85.	J. Lloyd (Birmingham). (Private).	M., 26	Lumbar.	Nephritic abscess.	7 mos.	12 ounces of pus, pyuria, sinus continues open.	—	R.

NEPHROTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
41	8. vii. '85.	A. E. Barker (London). (Private.)	M., 22	Lumbar.	Gonorrhœal pyelitis.	—	Perinephritic abscess in addition, no calculus; complete relief.	—	R.
42	17. viii. '85.	Ferreri. *La Sperimentale*, xi. 1885.	F.	Do.	Suppurating kidney, left.	—	Kidney converted into a purulent sac.	—	R.
43	31. i. '86.	W. Goodell (Philadelphia). (Private.)	F., 29	Do.	Surgical kidney.	1 year.	Kidney much enlarged by distended cavities—pus.	—	R.
44	2. iv. '86.	Reliquet (Brodeur).	M., 40	Do.	Abscess in kidney.	—	Diagnosis confirmed; persistent fistula.	—	R.
45	—	H. E. Rawdon (Liverpool). (Private.)	M., 7	Do.	Renal Abscess.	—	Disorganisation of right kidney; bladder and left kidney diseased; death on 33rd day.	D.	—
46	2. v. '86.	A. C. Taylor (Nottingham). (Private.)	F., 21	Do.	Pyonephrosis.	—	Diagnosis confirmed.	—	R.
47	1886.	John Duncan. (Private).	M., 28	Do.	Abscess from calculus.	Many years.	Abscess, but no calculus; sinus left.	—	R.
48	6. x. '86.	Maclaren (Carlisle). (Private.)	F., 43	Do.	Suppuration.	6 mos.	Diagnosis confirmed; sinus remains; health good.	—	R.
49	14. x. '86.	Edel. *Arch. f. Klin. Chir., Berlin*, 433, xxxiv.	—	Do.	Suppurating kidney.	—	Kidney contained ½ Letre of pus.	—	R.

The following table shows the general result:—

NEPHROTOMIES FOR SUPPURATIVE DISEASE WITHOUT CALCULUS.

	Males.	Females.	Sex not stated.	Recoveries.	Deaths.
Lumbar, . . .	21	23	2	35	11 = 24 °/。
Abdominal, . .	—	3	—	1	2 = 66·6 °/。
	21	26	2	36	13 = 26·5 °/。

The mortality in the male cases of lumbar nephrotomy is a little higher than that of the female. Out of the 21 males operated upon 6 died, while out of 23 females only 4 died.

The causes of death in the 13 fatal cases were as follows:

	Abdominal.	Lumbar.	Nos. of Cases.
Peritonitis, ...	1	2	1, 5, 39
Shock and Collapse, . . .	1	1	23, 24
Broncho-pneumonia, . . .	—	1	9
Pulmonary Congestion, . . .	—	1	33
Uræmia and Suppression of Urine, .	—	2	28, 36
Cause unknown, ...	—	4	3, 25, 35, 45
	2	11	

In most cases nephrotomy and free drainage are followed by shrinking and final closure of the sac; but should this not happen, and should the patient suffer from a continuous and not perceptibly diminishing purulent discharge from the sinus, with all its risks and attendant discomforts, nephrectomy should be performed. The argument brought forward in favour of this further operation is: that prolonged suppuration is liable to lead to serious structural disease of the kidney on the opposite side, either by a process of infection or by inducing amyloid infiltration—a condition not necessarily limited to the kidney, but one which may extend to other viscera. How long a pyonephrosis or suppurating kidney should be allowed to drain through the loin is a question which must be answered by a due consideration of the facts of the individual case; but, as a general rule, it may be said that if there be evidence that the other kidney is healthy, that the diseased one is not necessary for the work, and that the quantity of pus is not diminishing, while the patient is losing rather than gaining strength, the sooner nephrectomy is performed the better.

We may now proceed to examine the table of Nephrectomies for Suppurative Disease without Calculus (page 237).

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	23. iii. '71.	V. Bruns (Tübingen). *Simon Chir. der Nieren*, 1876, ii, p. 54.	M., 21	Lumbar.	—	15 mos.	Death in ten hours from collapse.	D.	—
2	22. v. '79.	Czerny. *Centb. f. Chir.*, 1879, No. 45.	F., 32	Do.	Pyonephrosis of left kidney with fistula.	4 years.	Kidney suppurating.	—	R.
3	24. iv. '80.	Cowper. *Med. Times and Gaz.*, 1880, ii, p. 583.	F., 17	Do.	Pyonephrosis of right kidney.	1 year.	Escape of pus into the peritoneum during the operation.	—	R.
4	10. i. '81.	Czerny. *Braun, D. Med. Woch.*, 1881, 32.	F., 35	Do.	Do.	1 year.	Diagnosis confirmed.	—	R.
5	31. i. '81.	Clementi (Catania). *Amer. Jour. Med. Sci.*, 1882.	F., 28	Do.	Pyonephrosis of left kidney.	—	—	—	R.
6	1881.	Bardenheuer. (Private.)	M., 26	Do.	Pyonephrosis with perinephritic abscess.	—	—	—	R.
7	29. xi. '81.	Frattini. *Gaz. degli. Osp.*, 1883.	F., 28	Do.	Pyonephrosis of left kidney.	—	Multiple abscesses of kidney. No *post-mortem*.	D.	—
8	4. xi. '81.	Czerny. *Jong.*	F., 43	Do.	Do.	2 years.	A fistula remained for some time.	—	R.
9	xii. '81.	Marsh. *Lancet*, 1882, i, April 22, p. 648.	M., 35	Do.	Pyonephrosis of right kidney.	3 years.	Renal abscess; died in 30 hours from uræmia or collapse.	D.	—
10	8. iii. '82.	Lawson Tait. *Brit. Med. Jour.*, 1882, Nov. 11, p. 929.	F., 24	Do.	Do.	—	—	—	R.

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
11	10. vi. '82.	Bardenheuer. (Private).	F., 5½	Lumbar.	Nephritic and perinephritic abscess of left kidney.	—	Diagnosis confirmed.	—	R.
12	11. xii. '82.	Vecchi (Paolo de). *N. Y. Med. News*, 1883.	F., 33	Abdominal.	Pyonephrosis of right kidney.	—	Suppurating cystic kidney.	—	R.
13	28. xii. '82.	D'Antonia. *Centb. f. Chir.*, 1883, No. 31.	F., 26	Lumbar.	Pyonephrosis of right kidney.	—	Kidney suppurating.	—	R.
14	3. iii. '83.	West. *Lancet*, 1883, March 10. p. 424.	M., 15	Do.	Pyonephrosis of left kidney.	4 mos.	Voluminous kidney, with abscess.	—	R.
15	11. iii. '83.	Elder. *Lancet*, Aug. 1885.	F., 45	Do.	Acute suppurative nephritis.	—	Kidney converted into large abscess cavity; renal tissue destroyed; other kidney undergone extensive fatty degeneration; uræmia.	D.	—
16	9. iv. '83.	Whitehead. *Brit. Med. Jour.*, 1883, i, June, p. 1226.	F., 45	Abdominal.	Pyonephrosis of left kidney.	1 year.	Kidney suppurating; death from shock.	D.	—
17	1883.	Bergmann (V). *Berl. Klin. Woch.*, 1883.	F.	Lumbar.	Pyonephrosis.	—	Kidney suppurating; death from shock.	D.	—
18	1883.	Palmer (C. D.) *Med. News*, 1883.	F., 19	Abdominal.	Pyonephrosis of right kidney.	—	Kidney with abscesses; death on fourth day; no *post-mortem*.	D.	—
19	8. x. '83.	Bergmann (V). *Berl. Klin. Woch.*, 1885, Nos. 46, 47, 48.	F., 24	Lumbar.	Pyonephrosis of left kidney.	—	Nephrotomy 18 days before operation.	—	R.

20	13. ix. '83.	Czerny. *Jong's Statistics.*	M., 39	Lumbar.	Pyonephrosis.	2½ years.	Nephrotomy was performed 23rd Nov., 1882, and pus evacuated.	—	R.
21	25. i. '84.	Czerny. *Jong.*	F., 22	Do.	Pyonephrosis of left kidney with fistula.	6 years.	Nephrotomy performed in Dec., 1883; recovery in two months.	—	R.
22	28. i. '84.	Czerny. *Jong.*	M., 35	Do.	Dermoid cyst.	5 years.	Death in four days from septicæmia.	D.	—
23	24. iv. '84.	D'Antona. *Lancet*, 1884, ii, Dec. 13, p. 1,055.	M., 34	Do.	Pyonephrosis of right kidney.	10 years.	Death in ten days from collapse.	D.	—
24	—	Weir (New York). *Centb. f. Chir. Med. Weiss.*, 1885, No. 18.	F., 23	Do.	Pyonephrosis and cystitis.	4 years.	Died in ten hours from shock; multiple abscesses.	D.	—
25	7. ii. '84.	Bergmann (Von), *l.c.*	F., 31	Do.	Pyonephrosis, left kidney.	—	Eight abscesses in kidney.	—	R.
26	18. ix. '84.	Bergmann (Von). *l.c.*	F., 20	Do.	Do.	—	Kidney suppurating; lumbar nephrotomy performed in Aug. 1883; suppurating lumbar fistula for six weeks.	—	R.
27	6. x. '84.	Gardner. *Austral. Med. Jour.*, 15. iv. '85.	M., 42	Abdominal.	Abscess of right kidney.	—	Kidney suppurating, and great degeneration in left kidney; death from suppression of urine.	D.	—
28	i. '85.	Robson (Mayo). (Private.)	F., 57	Do.	Abdominal cyst.	—	Stenosis of ureter and dilatation of kidney in large cyst containing grumous matter; death from acute mania 14 days after operation.	D.	—
29	17. i. '85.	Iterson. *Jong.*	F., 26	Lumbar.	Calculous pyelitis.	12 years.	Suppurative nephritis; no stone discovered.	—	R.
30	20. i. '85.	Trélat. *Bull. de la Soc. de Chir.*, 1885, 826.	F., 35	Do.	Pyonephrosis of right kidney.	—	Kidney suppurating; right kidney large and white; fæcal fistula established; died, 6th Feb., 1885, from exhaustion.	D.	—
31	1. v. '85.	Verneuil (Brodeur). *These de Paris*, 1886.	F., 31	Do.	Hydronephrosis, suppurative.	—	Purulent pleurisy and peritonitis; interstitial nephritis of remaining kidney.	D.	—

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITHOUT CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
32	18. vi. '85.	Clementi. (Private.)	F., 34	—	Pyonephrosis.	—	Diagnosis confirmed; cause of death not stated.	D.	—
33	iv. '85.	Leopold (Private.)	F., 46	Lumbar.	Pyonephrosis, left side.	10 years.	—	—	R.
34	10. iv. '85.	Bergmann. *l.c.*	M., 52	Do.	Pyonephrosis of right kidney.	—	Kidney suppurating; persistence of small suppurating fistula for 12 months; organ removed 12 times larger than normal state.	—	R.
35	16. iv. '85.	Lawson Tait. *Birm. Med. Rev.*, Sept., 1885.	M., 45	Abdominal.	Multiple abscesses of right kidney.	—	Kidney suppurating; taken for a solid tumour; death from shock 26 hours after operation.	D.	—
36	18. vi. '85.	Lawson Tait. *Ibid.*	F., 45	Do.	Cyst of the mesentery.	—	Disorganisation of the kidney.	—	R.
37	viii. '85.	Ollier. *Revue de Chir.*, 1885, p. 849.	M.	Lumbar.	Pyonephrosis of left kidney.	—	Kidney suppurating.	—	R.
38	13. vi. '85.	Lucas Championnière. (Brodeur.)	F., 40	Abdominal.	Pyonephrosis of right kidney.	—	Numerous abscesses in kidney.	—	R.
39	vi. '85.	Bergmann. *l. c.*	F., 31	Lumbar.	Perinephritic abscess.	—	Lumbar fistula; death from suppression of urine.	D.	—
40	10. v. '85.	Bardenheuer. (Private).	M., 33	Do.	Perinephritic abscess in left kidney.	—	Diagnosis confirmed.	—	R.
41	23. x. '85.	Bardenheuer. (Private.)	F., 34	Do.	Pyelitis left side.	—	Severe nephritic colic.	—	R.
42	26. xi. '85.	Lange. *N. Y. Med. Jour.*, 1886, p. 108.	F., 26	Do.	Pyonephrosis of right kidney.	—	Cystic degeneration; kidney suppurating.	—	R.

43	1885.	Danillo Vincenzo. *Rev. Scien. Med.*, xxvii, 296.	M.	Lumbar.	Pyonephrosis.	—	Kidney suppurating.	—	R.
44	1885.	R. G. Bogue. *Ibid.*, p. 296.	F., 36	Do.	Do.	—	Do.	—	R.
45	10. ii. '86.	Lucas Championnière. (Brodeur.)	F., 26	Abdominal.	Pyonephrosis of left kidney.	—	Kidney suppurating; death from shock 4 hours after operation.	D.	—
46	14. iii. '86.	Legoud. (Brodeur.)	F., 28	Lumbar.	Hydronephrosis of left kidney.	—	Suppuration of the kidney.	—	R.
47	30. iv. '86.	Clementi (Private.)	F., 36	—	Pyonephrosis.	—	Diagnosis confirmed.	—	R.
48	18. v. '86.	Owen. (Private.)	F., 44	Abdominal.	Cystic disease of left kidney.	10 years.	Cystic disease; chronic suppuration; renal tissue entirely destroyed; cyst contained 10 oz. thick light green pus.	—	R.
49	1. vii. '86.	Bardenheuer. (Private.)	M., 42	Lumbar.	Nephritis and Perinephritic abscess.	—	Diagnosis confirmed.	—	R.
50	9. x. '86.	Lange (F.) *Ann. Surg.*, St. Louis, 1887.	M., 38	Do.	Pyonephrosis.	2 years.	Kidney in advanced stage of degeneration from pyonephrosis.	—	R.
51	9. xii. '86.	M'Laren (Carlisle). (Private.)	F., 25	Do.	Suppurating kidney.	5 years?	Kidney shrivelled and suppurating; has been drained for five years; recovery, with trace of pus in urine.	—	R.
52	5. ii. '87.	Thiriar. *Rev. de Chir.*, i, 1888.	M., 20	Do.	Suppurative nephritis with vesical tumour.	3 years.	Abscess in kidney and suppurative nephritis.	—	R.
53	30. iv. '87.	Thiriar. *l.c.*	F., 51	Do.	Tumour of right kidney.	2½ years.	Suppurative nephritis with infarction.	—	R.
54	1887.	Lange. *N. Y. Med. Jour.*, xlv, 244.	—	Do.	Pyonephrosis.	—	Diagnosis confirmed; former nephrotomy; profuse hæmorrhage.	—	R.

The following table shows the general result:—

NEPHRECTOMIES FOR SUPPURATIVE DISEASE WITHOUT CALCULUS.

	Males.	Females.	Sex not Stated.	Recoveries.	Deaths.
Lumbar, . . .	14	29	1	32	12 = 27·3 °/o
Abdominal, . .	2	8	—	4	6 = 60 °/o
	16	37	1	36	18 = 33·3 °/o

Of the 54 cases operated upon, in 44 the lumbar operation was adopted (29 females, with 8 deaths; 14 males, with 4 deaths; 1, sex not stated, recovered); and in 10 cases the abdominal operation was performed (8 females, with 4 deaths; and 2 males, with 2 deaths).

The causes of death in the 18 fatal cases were as follow:

	Abdominal.	Lumbar.	Nos. of Cases.
Shock and Collapse, ...	3	6	1, 9, 16, 17, 23, 24, 30, 35, 45
Pyæmia and Septicæmia, . .	—	1	22
Uræmia and Suppression of Urine,	1	2	15, 27, 39
Peritonitis, ...	—	1	31
Acute Mania, ...	1	—	28
Cause unknown, ...	1	2	7, 18, 32
	6	12	

In pyelonephritis and acute suppurative nephritis the prospect of successful treatment depends entirely upon the cause of the disease. When of traumatic origin, some success may be looked for from complete rest in the recumbent posture, together with antiphlogistic treatment—cupping, the application of ice, and the administration of opium, together with careful regulation of diet. By such methods the inflammation may be limited; but should it extend, and the symptoms become those of septic poisoning, treatment is very hopeless.

Prophylaxis against pyelonephritis is most important. In cases where there is obstruction to the escape of urine from any cause, the greatest precautions should be taken in the use of instruments, as this disease is so frequently associated with catheterisation, especially when there has been prolonged urethral obstruction. But while the catheter must be used with care, the want of its employment from fear of producing septic infection is equally dangerous. Where there is obstruction associated with an ammoniacal state of the urine, two points require to be attended to:— The obstruction must be relieved completely, but with as little local irritation as possible; and an endeavour must be made to prevent the decomposition of urine, and to restore the vesical mucous membrane to a healthy condition Acid solutions naturally suggest themselves as the most suitable injections for washing out the bladder; hence Dickinson states that he has had the best results from an injection of 10 ounces of water containing 15 drops of dilute nitric acid, and 10 grains of quinine, together with the internal administration of sulphuric acid. Traube recommends the employment of a solution of half a grain of acetate of lead to 4 fluid ounces of water, and the internal administration of from 1 to 1½ grain doses of tannic acid, in the form of a pill, every two hours. Other writers advise the use of injections of Condy's fluid, carbolic acid, perchloride of mercury, and other antiseptics. The injection I prefer to all others is prepared by mixing a concentrated solution of boracic acid with equal parts of a solution containing half a grain of quinine to the ounce of water.

Suppose, however, that pyelonephritis or suppurative nephritis has become established. The patient must be at once confined to bed, and if he is sufficiently strong, one or both loins should be cupped, hot fomentations applied, and the bowels kept well open by mild purgatives or warm enemata. The diet should consist of soups and milk; but if there be much asthenia, free stimulation may be called for; and should the disease be advanced, the treatment becomes practically that of septicæmia. The quantity of fluid allowed to the patient must be regulated by the requirements of the individual case. When the urine is scanty, diluents—such as barley water, linseed tea, or simply warm water—may be given in large quantities, but saline diuretics should be avoided; and when the reduction in the quantity of urine is associated with constipation, strong purgatives must be given. On the other hand, should constipation be associated with the secretion of an unduly large quantity of urine, Morris recommends a few doses of ergot of rye, as by its action upon the involuntary muscular fibres of the gut the constipation is overcome, and by its influence on the coats of the blood-vessels the renal circulation is restricted and regulated.

In cases of primary perinephritic abscess, or in those where the disease is the effect of injury, good results may be had from absolute rest, together with the local employment of cold applications and cupping, and an active purgative. Ice bags or cold compresses should be applied so long as the patient experiences relief from pain, and there is no redness of the skin or evidence of fluctuation. Should, however, the integuments become inflamed, even although fluctuation cannot be detected, cold applications must be discontinued and hot emollient poultices be employed in their place. If the inflammation then subsides, resolution of the inflammatory products may be promoted by the careful use of mercurial inunctions, or of an ointment containing iodide of potassium and iodide of lead. Pain may be relieved either by the local application of a liniment formed of equal parts of hydrate of chloral and camphor, or it may be controlled by the administration of morphia by the mouth, by the rectum, or hypodermically. On the first suspicion of suppuration the organ should be explored by an aspirator needle, and on no account should the surgeon wait till the pus approaches the surface, as by doing so his operation may be forestalled by the evacuation of the abscess by one of the channels mentioned to you when we were studying the morbid anatomy of this disease. The indications which demand an incision are increase in the swelling in the renal region, augmentation of the pain and fever, rigors, redness and œdema of the skin over the affected kidney.

The success which has followed evacuation depends upon the cause of the abscess, and the constitutional condition of the patient. Instead of using the knife, escharotics have been employed by timid practitioners for the purpose of avoiding hæmorrhage, and promoting adhesions between the kidney and the abdominal wall. The latter precaution is unnecessary, seeing that the kidneys are not within the peritoneal cavity. Further, opening the abscess by escharotics does not protect against hæmorrhage, and moreover, is more painful and less effective than a free incision with a bistoury. In like manner the aspirator has been called into request for the purpose of evacuating the pus. Some cases have given a good result after repeated tapping, but the number in which complete recovery may be looked for, as a consequence of this mode of treatment, must be small, seeing that in the great majority of instances the suppuration around the kidney is secondary to such conditions as pyelonephritis, or suppurative nephritis, arising as a consequence of renal calculus, an impediment to the outflow of urine, tuberculosis, or localised septic infection.

The advantage of free incision is clearly shown by the following statistics, reported in the *British and Foreign Med. Chir. Rev.*, xlviii, by Poland, in reviewing two articles on perinephritic abscess, one by Trousseau, the other by Dr. Bowditch :—He shows that of 28 cases of primary perinephritic abscess, in 8 there was no operation; of these cases, in one instance, the abscess burst into the bladder and vagina, with recovery, and in one it burst into the lung, with relief. In the remaining 6 death ensued, the abscess bursting into the colon in two cases, into the lung in two cases, into the peritoneum in one case, and in one case it passed down into the pelvis. In two cases caustic potash was used as a means of opening the abscess. In three the trochar and cannula was the means employed, but only effectively in one of these. In 15 cases free incisions were used, and recovery ensued in all except one, where the patient died from diarrhœa, hectic fever, and exhaustion.

I have not considered it advisable to place before you a complete list of the cases of perinephritic abscess operated upon, and recorded up to the present time, which number over 200, as this has already been almost completely done by Nieden, to whose article on the subject I have already referred. He has tabulated 166 cases.

When perinephritic inflammation is known to exist and is associated with fever, and other evidences of suppuration taking place, even although fluctuation cannot be detected, recourse should be had to the knife in order to set the pus free at once. When the superficial parts, which are generally more or less softened, have been incised, the finger should be introduced into the wound, and with it the deeper tissues may be torn apart. By the careful and educated use of the finger, the direction in which the pus is lying can be appreciated more easily and more accurately than by any other means. Should the pus be situated very deeply, an aspirator needle, or a grooved director may be used for exploration. When the abscess is discovered it may be easily evacuated by introducing a narrow-bladed knife, and afterwards the incision may be enlarged, without danger from hæmorrhage, by inserting into the wound a pair of closed dressing forceps, then separating the blades and withdrawing the forceps.

We now come to the consideration of the treatment of one of the most interesting and important surgical affections of the kidney—namely, that of renal calculus. Necessarily the treatment must be modified according to the character of the stone, the anatomical changes in the kidney and the urinary tract, and the symptoms to which the calculus gives rise.

Should a tendency to the formation of renal sand or gravel be evinced, our first object must be to prevent the formation of a calculus, but if a stone has already formed then the endeavour of the physician or surgeon is either to palliate the symptoms, or, if the case be a suitable one, to remove the stone by operation.

We will consider these points in their order.

To prevent the formation of a renal calculus in individuals known to be predisposed to it, a matter of first importance is careful regulation of the diet. When I brought under your notice the mode of formation and composition of renal calculi (page 169), you will remember that in a large proportion of cases the nucleus of the concretion was found to be composed of uric acid, hence, other things being equal, conditions which are known to augment the elimination of that material should be avoided.

The circumstances which cause an increase in the excretion of uric acid have been carefully studied both from the physiological and the pathological standpoint. According to Ranke the variations in the daily quantity in health are considerable, and while in a great measure independent of sex, height, weight, and temperature, the amount is largely regulated by the quantity and composition of food, diminishing to a minimum of 3·7 grains during abstinence, and rising to 32·5 grains on a full meat diet. It has also been pointed out by Haughton that a vegetarian diet causes less elimination of uric acid than animal food, while Flint has endeavoured to show that muscular exercise has the effect of increasing the percentage of free and combined uric acid in the renal excretion. The conditions just mentioned are by no means the only causes of uric acid sediments.

In the first place, it must be borne in mind that the precipitation of uric acid, in the form of a microscopic sediment, or of renal sand, is not necessarily indicative of the presence of an abnormally large amount of that material in the urine; uric acid is eliminated in combination with the alkalies, and whether or not it is deposited from the urine depends largely upon whether the quantity of free acid in the urine is large or small. It is well known, but perhaps not sufficiently remembered, that a urine which is highly acid, even though it contains relatively a small amount of uric acid, may deposit a large sediment, while another urine, which contains more uric acid, may hold it in combination with alkalies on account of the feebly acid reaction of the excretion. The deposit of a sediment of uric acid is, of course, favoured by concentration of the urine.

With these facts before us it is easy to see what the prophylaxis should consist of. The first point of importance is to give the patient large quantities of fluid, the second is to reduce the acid reaction of the urine, and the third is to regulate the diet and mode of life of the patient, so as to diminish the amount of uric acid eliminated.

In cases in which the urine is strongly acid and the sediment large, the patient's diet should consist of vegetables and milk, with waters containing alkalies or alkaline carbonates, and he should be enjoined to take moderate outdoor exercise, and as soon as the acidity of the urine has been reduced animal diet may be indulged in, but always along with an abundant supply of fluids. The patient should live sparely, avoid all fermented liquors, sweets, and pastry. The bowels must also be regulated by salines, such as Carlsbad, Pullna, or Friedrichshall waters; or waters containing large quantities of carbonate of soda, with free carbonic acid, may be administered for the purpose of neutralising the acidity of the urine. Because of the resemblance in the symptoms produced by strongly acid urine to those of renal calculus, the remedies which have been found to be efficient in their treatment have been suggested for the purpose of promoting the absorption or solution of concretions already formed. Some practitioners have boasted of their success; but on careful enquiry it will be found that in many, if not in all, of these so-called cases of "successful treatment by solvents" the patient suffered from symptoms all of which might be reasonably attributed to the acid condition of the urine.

Great diversity of opinion exists as to what diet should be allowed, and what fluids are best suited for the purpose of keeping the uric acid in solution. It does not, however, appear to me to be a question of solution, seeing that uric acid is only soluble in water to the extent of one part in ten thousand, but really one of keeping the uric acid in combination. Consequently foods and fluids rich in alkalies which reach the kidney unaltered are the most suitable; but at the same time it must be remembered that while it is desirable to reduce the acidity of the urine, and to diminish the tendency to formation of a uric acid calculus, alkalies should not be administered in such quantities as to give the urine an alkaline reaction, as by so doing the treatment, by inducing a precipitation of phosphates, may prove more injurious than beneficial. While a moderate amount of animal diet must not be looked upon as harmful, anything approaching excess in the consumption of azotised substances (in so far as they are liable to lead to an increase in the amount of uric acid eliminated, to a concentration of the urine, and to an acid reaction of that fluid), is, if persisted in, dangerous, and liable to conduce to the formation of a uric acid renal calculus.

In the treatment of what has been termed the oxalic acid diathesis, it is advisable to direct the patient to partake of large quantities of water free from alkalies or alkaline earths. Distilled water or very soft water should only be used, and the patient should be enjoined to avoid any substances, such as rhubarb, known to contain oxalic acid. As respects diet, little further need be said than that it is necessary to give the patient a liberal diet, plainly cooked and free from sugar in any form. Together with nitro-muriatic acid, tonics such as quinine, iron, and strychnia should be given, and exercise in the fresh air should be encouraged.

When a calculus has formed, the treatment may be symptomatic or radical. The former must be directed according to the individual requirements of the case.

Pain may be alleviated during an attack of renal colic by the administration of anodynes such as morphia, opium, and belladonna, or by the employment of hot medicated fomentations, emollient enemata, cupping of the loins, and hot baths. Should the pain be extreme, it may be necessary to place the patient under the influence of chloroform or ether, which may not only have the effect of relieving the suffering of the patient for the time being, but may also by abolishing spasm facilitate the passage of a calculus from the ureter. Under similar circumstances it has also been advised to give warm diluents and diuretics, with the view of forcing the calculus down by an increased secretion of urine, but probably the beneficial action of these remedies is due more to the power they possess of reducing the irritating qualities of the urine, than to any mechanical effect the pressure of urine may exert. When the pain is intermitting, benefit may be had from treatment directed towards improvement of the general health, from open air exercise, tonics, and careful regulation of diet. Changes in the position of the patient sometimes cause relief from suffering, either by altering the situation of the stone, or dislodging it from the ureter. In the same way external manipulation in the renal region, or along the course of the ureters has been recommended.

With these brief remarks on the treatment of pain, I may say just a word respecting the treatment of calculous hæmaturia. The loss of blood is seldom severe, and drugs are not often required; rest in the recumbent posture being, even in the event of profuse hæmorrhage, sufficient to effect a cure. Should, however, the loss of blood become a source of danger, or when small in amount be unduly prolonged, styptics such as gallic acid, ergot, opium or any of the mineral astringents may be given, and cold local applications may also be employed.

The treatment of suppurative disease of the kidney independent of calculus, has already been brought under your notice (page 229). I have now to ask your attention to the radical treatment of renal calculus with and without suppuration; and in the first place we must consider the conditions under which operative treatment should be resorted to, and in the second, the particular operations which should be selected in individual cases.

There is still much to learn respecting the symptoms which justify the surgeon in performing or refusing to perform operations for renal calculus. Incisions have been made for what have been regarded as typical cases of renal calculus, in which, on exploration in the loin, no stone was discovered, but fortunately, as I shall show you when we come to examine the results of nephro-lithotomy, the lumbar incision in non-suppurative cases is practically devoid of danger.

The symptoms which characterise renal calculus, as I have already said, are lumbar pain, extending at times to the groin and testicle, paroxysmal, aggravated by movements, and accompanied or followed by hæmaturia, pyuria, and frequent micturition; but while these are the indications of renal calculus, experience has abundantly shown that all these symptoms may be present without the existence of a stone in the kidney, or the presence of vesical disease. And, on the other hand, calculi may exist in the kidney for years, and lead up to a fatal termination, without the development of symptoms indicative of their presence.

In an admirable address "On Some Points in the Surgery of the Kidneys," Mr. Henry Morris summarises the conclusions to which he has come in the following propositions:—

"1. Although hæmaturia, associated with frequency of micturition and a small amount of pus in the urine is, in the absence of disease in the lower urinary tract, strong evidence in favour of renal calculus, yet pain, either in the loin, groin, or testicle, of one side, is also needed to justify the surgeon to explore the kidney through the loin.

"2. Pain alone, when persistent, or frequently paroxysmal, and giving rise to sickness and sweatings, or subject to exacerbations during perfect rest, justifies lumbar exploration. When there is a history of hæmaturia without pus, or a trace of pus without a history of hæmaturia, associated with one-sided pain, the exploration ought to be made if alkaline treatment have failed.

"3. When the above symptoms occur in persons with acid urine, or of gouty tendency, or who lead sedentary and indulgent lives, alkaline treatment and diet ought to have a prolonged trial before proposing an exploratory incision.

"4. When the urine is alkaline from carbonate of ammonia, and not from fixed alkali, the alkaline-treatment should be tried, on the ground that urine, very acid when secreted, irritates and inflames the mucous membrane, and so causes the alkalinity which is found when the urine is discharged from the body.

"5. Under certain circumstances, an abdominal exploration in search of calculus is justifiable when there is nothing to specialise which kidney is the seat of the stone.

"6. If strumous, not calculous, kidney causes the above symptoms, the lumbar incision of the kidney may give great relief, by affording exit to pent-up pus. An exploratory incision, under these circumstances, is a very advantageous thing.

"7. Under the circumstances previously stated, digital exploration of the bladder, in search of calculus in the ureter, ought to be made; and, if a stone be found in the vesical orifice, it ought to be removed.

"8. Removal of a calculus impacted in the ureter, by intraperitoneal urethrotomy, is feasible, and in certain cases ought to be practised.

"9. Exploration of the kidney should not be considered complete till incision of its substance has allowed of the thorough examination of the calices; and nephrectomy for calculus, in kidneys not disorganised, ought not to be entertained until after free incision of the kidney and digital exploration of the bladder have failed to disclose the calculus.

"10. Exploration of the bladder, in the female certainly and in the male generally, ought to be made before nephrectomy is resorted to for hydronephrotic and pyonephrotic tumours.

"11. A stone in one kidney will sometimes excite sympathetic pain and irritation in the opposite one; but this transferred pain is of an aching character, not spasmodic or colicky, and it should not deter the surgeon from exploring where there is well marked and frequently recurring pain in the opposite loin.

"12. Experience suggests that after lumbar exploration of the kidney the patient should keep on his back, and a well adjusted compress should be placed on the abdomen over the front of the organ explored; as there is, though rarely, a tendency for the kidney to fall away from the loin, and delay the completion of the healing of the wound."

Nature has shown us how renal stones may escape from the kidney by a protracted and dangerous process, and suggested to the thoughtful surgeon a much safer and more rapid means of delivering the patient from his disease. Although indicated by Hippocrates, the operation of nephro-lithotomy was not resorted to by surgeons until within recent times, on account of the difficulty they experienced in arriving at a correct diagnosis. This difficulty, although it still exists, is greatly reduced, so that now the surgeon does not, as in former times, require to limit his operation to assisting the escape of a stone, the presence of which is made evident through a sinus in the loin. Since Simon published his work on the surgery of the kidney in 1871, nephro-lithotomy has been placed on an entirely new footing, so that the surgeon of to-day, instead of being content to relieve the patient of renal stones, which have by a natural process found their way to the surface, anticipates nature, and removes the calculus before it has produced destructive changes in the renal tissue. In this way, not only is the kidney saved and the patient relieved, but by operating early in the course of the case, the immediate dangers of the operation are reduced to a minimum.

In collecting the statistics of nephro-lithotomies (page 258), I have, in the first instance, eliminated all cases in which the presence of a calculus was associated either with pyuria or with a collection of pus in the kidney, with the unexpected and wonderfully satisfactory result, that out of

42 cases there is not a single death. I find that Brodeur, in his statistics of 25 nephro-lithotomies, includes several in which suppuration co-existed with calculus, and in the operations included in his table he has two deaths, one a case of Durham's, operated upon in 1872, which should certainly not be included, as the patient died from shock after nephrectomy following upon a nephro-lithotomy performed some time before. The other case was one of Bennett May's, in which the patient suffered from almost constant pain in the right lumbar region for a period of fourteen years, associated not only with a variable hæmaturia but also with a pyuria.

In a number of the cases included in the table of nephro-lithotomies, no calculus was found, but, notwithstanding, in several of these the symptoms disappeared after the operation.

We may now proceed to examine the table of nephro-lithotomies for calculus combined with suppurative disease of the kidney. The facts there revealed are very different from those just referred to, even although in many of the cases included in the table (page 262), the amount of suppuration was very small. Of the 60 cases, in 53 the lumbar operation was adopted (31 females, with 10 deaths; 20 males, with 10 deaths; 2, sex not stated, with 1 death); in 6 the abdominal operation was performed (5 females, with 4 deaths; 1 male, with death); and in 1 the combined abdominal and lumbar incision was resorted to with a successful result.

The following table shows the general results:—

NEPHRO-LITHOTOMIES FOR CALCULUS WITH SUPPURATION.

	Males.	Females.	Sex not stated.	Recoveries.	Deaths.
Abdominal, . .	1	5	—	1	5 = 83 °/₀
Lumbar, . . .	20	31	2	32	21 = 39·6 °/₀
Combined Abdominal and Lumbar,	—	1	—	1	—
	21	37	2	34	26 = 43·3 °/₀

It will be observed that when the lumbar operation was employed, the mortality in male cases was much higher than in female cases, 20 of the former giving as many deaths as 31 of the latter.

The causes of death in the 26 fatal cases will be found as follows:—

	Abdominal.	Lumbar.	Nos. of Cases.
Collapse, Shock, and Exhaustion, .	—	8	4, 8, 10, 17, 23, 26, 37, 55
Pyæmia and Septicæmia, . . .	1	2	2, 35, 59
Uræmia and Suppression of Urine, .	1	4	31, 45, 47, 52, 53
Peritonitis, ...	—	1	32
Coma, ...	—	1	56
Heart-clot, ...	1	—	50
Tetanus, ...	—	1	36
Pneumonia, ...	—	1	13
Cause not stated, ...	2	3	1, 11, 16, 48, 60
	5	21	

Turning now to the Table of Nephrectomies for Suppurative Disease of the Kidney with Calculus (page 272), it will be found that 61 operations have been performed, the lumbar incision having been used in 44 cases (25 females, with 12 deaths; 18 males, with 4 deaths; 1, sex not stated, recovered); in 14 the abdominal (13 females, with 6 deaths; 1, sex not stated, recovered); and in 3 successful cases, the combined abdominal and lumbar.

NEPHRO-LITHOTOMIES FOR RENAL CALCULUS WITHOUT SUPPURATION.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	11. ii. '80.	Morris. *Brit. Med. Jour.*, ii, 1880.	F., 19	Lumbar.	Calculus, right.	8 years.	Kidney healthy, containing calculus.	—	R.
2	8. x. '80.	Le Dentu. *Brodeur*, 348.	M., 55	Do.	Calculus in left kidney.	—	Kidney healthy.	—	R.
3	16. viii. '81.	Beck. *Brit. Med. Jour.*, 7. ii. 1885.	M., 19	Do.	Calculus.	12 years.	Calculus (29 grs.); uric acid.	—	R.
4	25. x. '81.	H. T. Butlin. *Trans. Clin. Soc.*, vol. xv, p. 113.	M., 20	Do.	Do.	—	Oxalate of lime calculus (60 grs.)	—	R.
5	1881.	John Duncan. (Private.)	M., 40	Exploration.	Calculus?	Many years.	Uncertain; no calculus found; improved.	—	R.
6	28. ii. '82.	A. E. Barker (London). (Private).	M., 9	Lumbar.	Calculus.	3 years.	No calculus found; recovery from operation without much relief of symptoms.	—	R.
7	6. ii. '83.	Howse. *Brit. Med. Jour.*, 12. ii. 1885.	M., 57	Do.	Calculus without suppuration.	6 years.	Oxalate of lime (26 grs.)	—	R.
8	11. vii. '83.	Symonds. *Lancet*, 5. iii. 1885.	M., 50	Do.	Calculus, left.	24 years.	Kidney healthy; symptoms returned; suspicions of another calculus.	—	R.
9	10. ix. '83.	W. Anderson (London). *Brit. Med. Jour.*, 7. vi. 1884.	M., 20	Do.	Renal calculus.	11 mos.	Oxalate of lime calculus in pelvis of left kidney.	—	R.

10	12. xii. '83.	K. Thornton. *Med. Times*, 1885.	F., 25	Lumbar.	Calculus, right.	—	Kidney healthy.	—	R.
11	1883.	Hitch. *Med. Press and Circ.*, 4. vii. 1885.	M., 10	Do.	Calculus without suppuration.	—	Calculus (76 grs.)	—	R.
12	10. v. '84.	Morris. *Lancet*, 5. iii. 1885.	M., 24	Do.	Calculus, left.	Since infancy.	Kidney healthy; complete recovery.	—	R.
13	15. vi. '84.	Thornton (J. K.) *Intern. Med. Cong. Rep.*, ii, 154.	M., 40	Do.	Calculus.	—	Oxalate of lime calculus (93 grs.)	—	R.
14	15. x. '84.	J. Chiene. *Brit. Med. Jour.*, 1885, i, 280.	F., 29	Do.	Calculus, right.	4 years.	Kidney healthy; complete recovery.	—	R.
15	24. x. '84.	H. Morris. *Brit. Med. Jour.*, 1884.	M., 35	Do.	Calculus.	3 years.	Kidney healthy.	—	R.
16	3. xii. '84.	Macnamara. *Western Hosp. Rep.*, vol. i.	F., 34	Do.	Do.	—	Calculus without suppuration.	—	R.
17	1884.	Dickinson. *Brit. Med. Jour.*, 1885, i, 894.	M., 19	Do.	Calculus, right.	—	Calculus of 65 grains extracted; complete recovery in 5 months.	—	R.
18	12. i. '85.	W. Anderson (London). (Private.)	F., 24	Exploratory incision.	Probable renal calculus.	4 years.	No calculus detected; complete relief of symptoms four weeks after operation; relapse on two occasions.	—	R.
19	21. ii. '85.	Tiffany. *Med. News*, 1885.	26	Lumbar.	Calculus, right.	—	Calculus (556 grs.) removed.	—	R.
20	11. iii. '85.	Hill. *Lancet*, 13. vi. 1885.	M., 40	Do.	Do., do.	—	Kidney healthy; recovery at end of six weeks.	—	R.
21	26. iii. '85.	F. Imlach (Liverpool). *Med. Chir. Jour.*, 1885.	F., 26	Do.	Renal calculus.	2 years.	Sinus; phosphatic calculus in left kidney (106 grs.)	—	R.

NEPHRO-LITHOTOMIES FOR RENAL CALCULUS WITHOUT SUPPURATION—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
22	iv. '85.	Mayo Robson (Leeds). (Private.)	M., 39	Lumbar.	Renal calculus.	4 years.	No calculus found; cure of symptoms.	—	R.
23	15. v. '85.	E. Owen (London). *Brit Med. Jour.,* 10. x. 1885.	M., 19	—	Do.	12 mos.	Renal calculus of left kidney.	—	R.
24	23. v. '85.	L. Tait. *Birm. Med. Rev.,* ix. 1885.	F., 25	Lumbar.	Calculus, right.	6 mos.	Complete recovery.	—	R.
25	23. v. '85.	G. A. Wright (Manchester). (Private.)	M., 18	—	Renal calculus.	11 years.	Diagnosis confirmed.	—	R.
26	16. vi. '85.	L. Tait. *l.c.*	F., 52	Lumbar.	Calculus, right.	2 years.	Complete recovery.	—	R.
27	20. vi. '85.	Bennett May. (Private.)	F., 23	Do.	Renal calculus.	18 mos.	1 Calculus extracted; perfect recovery.	—	R.
28	13. vii. '85	L. Tait. *l.c.*	F., 59	Do.	Calculus, right.	—	Complete recovery.	—	R.
29	29. ix. '85.	J. Lloyd (Birmingham). (Private.)	M., 21	Do.	Renal calculus.	5 years.	Kidney substance normal; cystine calculus, 35 grs. removed.	—	R.
30	1885.	Kuester. *15th Cong. Soc. Alle. Chir.,* 1886.	—	Do.	Calculus.	—	Diagnosis confirmed.	—	R.
31	—	Wright. *Brit. Med. Jour.,* 2. i. 1886.	M., 19	—	Do.	11 years.	Calculus size of horse-bean; uric acid.	—	R.

32	30. i. '86.	Lauenstein. *Soc. Allg. Chir., Berlin,* 8. iv. 1886.	M., 30	Lumbar.	Calculus.	—	No fistula; large calculus.	—	R.
33	4. iii. '86.	Pickering. *Brit. Med. Jour.,* 1886, ii, 860.	M., 23	—	Renal calculus.	18 mos.	Uric calculus weighed 40 grains.	—	R.
34	15. v. '86.	Morris (H.) *Lancet*, 5. ii. 1887.	M., 42	Lumbar.	Renal calculus without suppuration.	—	Calculus 23½ grs. removed.	—	R.
35	vi. '86.	R. W. Parker London). (Private.)	F., 13	Do.	Renal calculus.	Several years.	Stone removed; complete recovery.	—	R.
36	vi. '86.	Mayo Robson (Leeds). (Private.)	M., 18	—	Calculus.	7 years.	Calculus the size of a filbert removed.	—	R.
37	8. viii. '86.	J. Lloyd (Birmingham). *Med. Rev.*, xx.	M., 19	Do.	Renal calculus.	12 years.	Recovery in 34 days; wound healed.	—	R.
38	23. viii. '86.	Bennett May. (Private.)	M., 32	Do.	Do.	10 mos.	Operation undertaken on evidence of pain only; urine normal; mulberry calculus 75 grs.	—	R.
39	2. x. '86.	J. Lloyd (Birmingham). *Med. Rev.*, xx.	M., 14	Do.	Do.	5 mos.	Recovery in 19 days; wound healed.	—	R.
40	9. xi. '86.	Page. *Edin. Med. Journ.,* 1887, iii, 789.	M., 15	—	Calculus in left kidney.	—	Oxalate of lime calculus.	—	R.
41	10. ii. '87.	Gardner (W.) *Lancet*, 4. vi. 87.	M., 23	Do.	Renal calculus.	3 years.	Do.	—	R.
42	7. iv. '87.	Jones. *Med. Chron.,* 1887, iii, 210.	—	Do.	Calculus.	9 mos.	Calculus removed; hæmaturia very marked symptom.	—	R.

NEPHRO-LITHOTOMIES FOR CALCULUS, WITH SUPPURATIVE DISEASE OF KIDNEY.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	23. vi. '72.	Andrew & Callender. *St. Barth. Hosp. Rep.*, ix, 220.	F., 44	Lumbar.	Calculus and pyelitis of right kidney.	—	Kidney contained a phosphatic calculus; persistence of pus in urine after the operation; death on 4th day; no *post-mortem*.	D.	—
2	24. x. '72.	Dawson. *N. Y. Med. Jour.*, Jan., 1873.	F., 50	Abdominal.	Calculus and pyelitis of left kidney.	8 years.	Kidney suppurating with calculi; death from pyæmia on 5th day.	D.	—
3	8. x. '73.	Wm. Ingalls. (Boston, U.S.) (Private.)	F., 31	Lumbar.	Calculous pyelitis.	—	Recovery complete with exception of sinus.	—	R.
4	28. x. '74.	Baker. *Trans. Med. Cong.*, vol. ii, 265.	F., 43	Do.	Do.	—	Eight ounces of pus withdrawn; branched calculus weighing 2 ounces, composed of phosphate of lime; death on 3rd day after operation from collapse; no *post-mortem*.	D.	—
5	29. i. '76.	Savoy. *St. Barth. Hosp. Rep.*, 1876.	F., 40	Do.	Renal abscess.	—	Stone measured 1½ inches by 1 inch; composed of uric acid.	—	R.
6	27. xii. '77.	Patterson. *Glas. Med. Jour.*, No. vii, 1879.	F., 38	Do.	Pyelitis.	—	Perinephritic abscess opened 3 months previously; calculi (uric acid) removed; sinus open June, 1879.	—	R.
7	1878.	Petersen. *Berlin. Klin. Woch.*, xiv, 192, 1880.	F., 39	Do.	Calculus and pyelitis with suppuration of right kidney.	8 years.	Kidney suppurating; calculus size of pigeon's egg.	—	R.

8	13. vi. '79.	Cullingworth. *Lancet*, i, 1880, p. 14.	F., 32	Lumbar.	Calculous pyelitis.	2 years.	Renal abscess originating in a fragment of carious vertebra, forming nucleus of renal calculus; multiple abscesses in kidney; death on 3rd day from exhaustion.	D.	—
9	xii. '79.	Macewen (Glasgow). (Private.)	F., 12	Do.	Pyonephrosis.	—	Large abscess in kidney, quantity of calculous matter evacuated; tube casts in urine.	—	R.
10	24. xii. '79.	Couper (London). (Private.)	F., 40	Do.	Calculous pyonephrosis.	2 years.	Pyonephrosis; 3 calculi removed; death in 12 hours from exhaustion.	D.	—
11	1879.	Hooper-May. *Lancet*, vol. ii, 6, 1880.	F., 55	Abdominal.	Calculous pyelitis, with suppuration of right kidney.	15 years.	Left kidney congested; calculus, uric acid and phosphates 630 grs.; death on 31st day; albuminuria and œdema; immediate cause of death not stated.	D.	—
12	2. xi. '80.	Rea. *Amer. Jour. Med. Sc.*, clxxii, 432.	18	Lumbar.	Calculus and fistula.	6 years.	Diagnosis confirmed; oxalate of lime calculus.	—	R.
13	1880.	Mynter. *Buff. Med. Surg. Jour.*, x. 1880.	F., 45	Do.	Calculous pyelitis of left kidney.	Many years.	Kidney suppurating with calculus; death from pneumonia; renal fistula on left side.	D.	—
14	20. iii. '81.	Whipham. *Lancet*, 4. ii. 1882.	F., 23	Do.	Calculous pyelitis of left kidney.	7 years.	Persistence of a small suppurating fistula for 4 or 5 months; calculi, 47 grains in kidney.	—	R.
15	vii. '81.	Macewen (Glasgow). (Private).	F., 18	Do.	Calculous pyonephrosis.	—	Small calculi removed, abscess in kidney.	—	R.
16	2. xi. '81.	W. T. Clegg (Liverpool). (Private.)	M., 31	Do.	Calculous pyelitis.	6 weeks.	Pear shaped calculus plugging lower end of left ureter; right kidney, very little kidney tissue left; three calculi in pelvis; recovery from operation; death ultimately.	D.	—

NEPHRO-LITHOTOMIES FOR CALCULUS, WITH SUPPURATIVE DISEASE OF KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
17	3. xi. '81.	Whipham. *Trans. Clin. Soc. Lond.*, 1882, xv, p. 123.	F., 56	Lumbar.	Calculous pyelitis of left kidney.	Several years.	Calculi in kidney, with suppuration; no calculus found at operation; death on 2nd day from collapse.	D.	—
18	1881.	Duncan. *Edin. Med. Jour.*, i, 1881.	M., 19	Do.	Do.	—	Small calculus supposed to be included in substance of kidney.	—	R.
19	9. ii. '82.	Thelen. *Centralb. f. Chir.*, xii, 1882.	F., 27	Do.	Calculous pyelitis of right kidney.	10 years.	Calculi in kidney, with urinary fistula.	—	R.
20	20. x. '82.	Bennett-May (Birmingham). *Brit. Med. Jour.*, 17. ii. 83.	M., 34	Do.	Calculous pyelitis.	17 years	Calculus weighed 473 grains; recovery; subsequent relapse of pus in urine.	—	R.
21	19. xii. '82.	J. Lloyd (Birmingham). (Private.)	F., 29	Do.	Do.	10 years.	Recovery from operation; recurrence of symptoms 18 months after.	—	R.
22	—	F. E. Bundy. *Boston Med. and Surg. Jour.*, 1882, 106.	F., 31	Do.	Calculous pyelonephritis.	10 years.	Calculus, about an ounce and a quarter in weight removed, sinus remained.	—	R.
23	—	Jones. *Brit. Med. Jour.*, 1883, i, 1069.	M., 46	Do.	Calculous pyelitis.	4 weeks.	Pus in right kidney; calculus, 105 grains; death from collapse in 24 hours.	D.	—
24	21. iii. '83.	B. Hill. *Dickinson*, vol. iii, p. 988.	F., 26	Do.	Renal suppuration.	Several years.	4½ ounces of pus removed by aspiration; oxalate of lime calculus, 64 grains.	—	R.

25	vi. '83.	Golding-Bird (London). (Private.)	F., 30	Lumbar.	Pyonephrosis from calculus.	9 years.	Some kidney structure remaining; several small calculi; recovery with sinus remaining.	—	R.
26	1883.	Güterboch. *Berl. Klin. Woch.*, 1883.	M.,	Do.	Calculous pyelitis of left kidney.	—	Kidney suppurating; *post-mortem;* right kidney also diseased, converted into purulent sac, with calculus; death 20 hours after from shock.	D.	—
27	8. v. '84.	Thornton, J.K. *Intern. Med. Cong. Rep.*, ii, 154.	M., 43	Do.	Calculous pyelitis.	—	Uric acid calculus (86 grains) removed; fistula and pyuria.	—	R.
28	8. 5. '84.	Rouse. *Trans. Clin. Soc.*, vol. xviii, 1885.	M., 19	Do.	—	10 years.	Pyelitis with calculus.	—	R.
29	2. vii. '84.	R. H. B. Nicholson. *Brit. Med. Journ.*, 5. ix. 1885.	F., 32	Do.	Calculous pyelitis.	2 years.	Calculus removed; complete recovery; small calculi passed by urethra.	—	R.
30	12. xii. '84.	J. K. Thornton. *Intern. Med. Cong. Rep.*, ii, 154.	F., 25	Abdominal and lumbar.	Do.	—	Calculus removed (uric acid), weighing 90 grains.	—	R.
31	2. i. '85.	Cullingworth. *Trans. Path. Soc., London*, vol. xxxvi.	F., 30	Abdominal.	Pyelitis with calculus.	—	Calculus removed from right ureter; impaction of calculus in each ureter; death from uræmia.	D.	—
32	29. i. '85.	G. A. Wright (Manchester). (Private.)	M., 44	Nephrolithotomy and Chole-cystotomy.	Renal and biliary calculi.	2 years.	Diagnosis confirmed; death from peritonitis.	D	—
33	30. i. '85.	Lauenstein. *Arch. f. Klin. Chir., Berlin*, 222, xxxiv, 1886-87.	M 30	Simon Czerny incision.	Calculous pyelitis.	10 years.	Large calculus removed from pelvis.	—	R.
34	14. ii. '85.	Hitch. *Med. Press and Cir.*, 4. vii. '85.	F., 22	Lumbar.	Pyelitis.	1 year.	Pyelitis with calculus, 96 grains.	—	R.

NEPHRO-LITHOTOMIES FOR CALCULUS, WITH SUPPURATIVE DISEASE OF KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
35	7. iii. '85.	Bennett May. (Private.)	M., 20	Lumbar.	Calculous pyelitis.	14 years.	Small stone, great hæmorrhage, plugging, pyæmia; death, 21st day.	D.	—
36	1. v. '85.	W. J. Walsham (London). *St. Barth. Hosp. Rep.*, 1885.	F., 63	Do.	Do.	5 mos.	Large calculus removed; *post-mortem*; found epithelioma of pelvis of kidney; tetanus on eighth day; death.	D.	—
37	12. v. '85.	Chavasse. *Lancet*, 1887, i, 480.	F., 22	Do.	Calculus with suppuration.	3 years.	No calculus or pus detected at operation; *post-mortem* revealed both; death from shock.	D.	—
38	21. v. '85.	A. E. Barker (London). (Private.)	F., 22	Do.	Calculous hydronephrosis.	—	Sacculated kidney due to obstruction; recovery with complete relief from pain; urinary fistula.	—	R.
39	2. vi. '85.	Bennett-May. (Private.)	M., 35	Do.	Calculous pyelitis.	10 years.	2 calculi extracted; operation undertaken on the evidence of pain only; perfect recovery.	—	R.
40	29. x. '85.	Clement Lucas. *Brit. Med. Jour.*, 1885, ii, p. 884.	F.	Do.	Calculous pyelitis of left kidney.	—	Calculi in kidney; right kidney removed in June, 1885.	—	R.
41	21. xi. '85.	Stone Croft. *Lancet*, 1886, i, 589.	F., 38	Abdominal.	Calculous pyelitis, with suppuration of right kidney.	14 years.	Kidney suppurating, with calculi.	—	R.
42	29. xi. '85.	F. Lange. *Med. News*, 16. i. 1886.	M., 30	Lumbar.	Calculus, left. Pyonephrosis, right.	—	Amelioration of symptoms.	—	R.
43	3. xii. '85.	G. A. Wright (Manchester). (Private.)	M., 35	Nephrolithotomy and Cholecystotomy.	Renal and biliary calculus.	8 years.	No calculus found, probably very small.	—	R.

44	5. xii. '85.	Mollière. *Lyon Méd.* 15. ii. 1885.	F., 42	Lumbar.	Calculous pyelitis, with suppuration of left kidney.	—	Suppuration of kidney; left kidney atrophied; uræmia.	—	R.
45	1885.	John Duncan. (Private.)	M., 35	—	Renal Calculus.	Many years.	Eight calculi removed; hydronephrosis, small, of other kidney from calculus in ureter; died from suppression of urine.	D.	—
46	1885.	Israel. *Chir. Cong. Berlin*, 1886.	F.	Lumbar.	Calculus.	—	Recovery; small calculus; perinephritic abscess opened previously.	—	R.
47	1885.	Browne. *Brit. Med. Journ.*, 1886, i, p. 448.	F., 50	Do.	Calculous pyelitis of right kidney.	—	Calculi in kidney; death from uræmia; right kidney with enormous calculus; left kidney, cystic and atrophied.	D.	—
48	1885.	Lucas. Championnière, (Brodeur.)	M., 46	Abdominal.	Calculous pyelitis, with suppuration of right kidney.	—	Kidney suppurating; extraction of a very large calculus; cause of death not stated.	D.	—
49	14. i. '86.	Carter & Paul. *Liv. Med. Chir. Jour.*, 480, vi, 1886.	F., 22	Lumbar.	Calculous pyelitis.	Many years.	Calculus, 105 grains, removed.	—	R.
50	21. i. '86.	Langley Browne. *Brit. Med. Jour.*, 1886, i, 820.	F., 46	Abdominal.	Calculous pyelitis, with suppuration of right kidney.	20 years.	Kidney suppurating; tumour adherent to intestine and mesentery; calculi weighed seven ounces; death on 11th day from "heart-clot."	D.	—
51	6. iii. '86.	Franks. *Brit. Med. Jour.*, 1886, i, 994.	M., 28	Lumbar.	Calculous pyelitis.	6 years.	Calculus, 171·3 grains; pus.	—	R.
52	8. iv. '86.	Le Forte. (Brodeur.)	M., 49	Do.	Calculous pyelitis of right kidney.	—	Calculus in kidney; no urine by wound; uræmia.	D.	—
53	v. '86.	R. W. Parker. *Lancet*, 1887, i, 625.	M., 12	Do.	Traumatic hydronephrosis.	4 mos.	Multiple calculi; impaction of calculus in ureter following injury; both kidneys diseased; death from uræmia after temporary relief.	D.	—

NEPHRO-LITHOTOMIES FOR CALCULUS, WITH SUPPURATIVE DISEASE OF KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
54	31. 7. '86.	W. J. Walsham (London). (Private.)	F., 43	Lumbar.	Calculous pyelitis.	Since childhood.	Calculus removed from upper end of ureter.	—	R.
55	10. viii. '86.	Chavasse. *Lancet*, 1887, i, 480.	M., 27	Do.	Renal calculus.	3 years.	Renal calculus, 30 grains; pus, 18 ounces; death from shock.	D.	—
56	18. vi. '86.	Morris (H.) *Lancet*, 5. ii. 1887.	F., 40	Do.	Calculus in right kidney.	—	Left kidney contained two cysts filled with pus and 200 small calculi; suppression of urine; death from coma on 5th day.	D.	—
57	—	Tiffany. *Med. News*, 16. iv. '87.	F., 27	Do.	Calculous pyelitis.	—	Calculus weighing 30 grains removed.	—	R.
58	—	Shepherd. *Med. News*, 23. iv. '87.	M., 26	Do.	Do.	7 years.	Calculus weighing 4 oz. 7 dr.; 9 inches in circumference; recovery from operation; died from septicæmia three and a half months after operation.	—	R.
59	—	Chavasse. *Lancet*, 1887, i, 480.	M., 31	Do.	Calculus.	10 years.	No calculus found at operation; *post-mortem* showed pyonephrosis and calculus, 288 grains; death from septicæmia.	D.	—
60	—	Teale. *Brit. Med. Jour.*, 1887, p. 45.	—	Do.	Renal calculus.	—	No stone found at operation, but discovered after death, which occurred a few weeks after operation; cause not stated.	D.	—

NEPHRECTOMIES FOR SUPPURATIVE DISEASE WITH CALCULUS.

	Males.	Females.	Sex not stated.	Recoveries.	Deaths.
Lumbar, . . .	18	25	1	28	16 = 36·3 °/o
Abdominal, . .	—	13	1	8	6 = 43 °/o
Combined Lumbar and Abdominal,	—	3	—	3	—
	18	41	2	39	22 = 36 °/o

Cause of death in the 22 fatal cases was as follows:—

	Abdominal.	Lumbar.	Nos. of Cases.
Shock and Collapse, ...	1	4	3, 10, 12, 18, 26
Pyæmia and Septicæmia, . . .	—	4	1, 20, 27, 48
Uræmia and Suppression of Urine, .	—	3	8, 38, 54
Peritonitis, ...	1	—	2
Hæmorrhage, ...	2	1	9, 14, 46
Phthisis, ...	—	1	24
Cancer, ...	—	1	31
Cause not stated, ...	2	2	5, 51, 55, 56
	6	16	

Having now considered the statistics of operations for suppurative disease of the kidney in detail, it may be interesting to place them together in order to ascertain the general facts.

Taking first, for the purposes of comparison and contrast, the Nephrotomies and Nephro-lithotomies for Suppurative Disease (1) with and (2) without Calculus.

		Males.	Females.	Sex not Stated.	Recoveries.	Deaths.
Lumbar, .	(1)	20	31	2	32	21 = 39·6 °/。
	(2)	21	23	2	35	11 = 24 °/。
Abdominal, .	(1)	1	5	—	1	5 = 83 °/。
	(2)	—	3	—	1	2 = 66·6 °/。
Abdominal and Lumbar,	(1)	—	1	—	1	—
	(2)	—	—	—	—	—
		42	63	4	70	39 = 35·8 °/。

From this table, including 109 operations, it will be seen that suppurative disease from renal calculus has a higher mortality throughout than suppurative disease of the kidney from other causes. It is also to be observed that in both conditions the abdominal operations are greatly above the average (35·8 per cent) in their mortality (83 per cent and ·66·6 per cent). The cases are, however, too few to draw any conclusion from them. The same may also be said respecting the nephrectomies for suppurative disease.

The Nephrectomies for Suppurative Disease (1) with, and (2) without Calculus are shown in the following table:—

		Males.	Females.	Sex not Stated.	Recoveries.	Deaths.
Lumbar, .	(1)	18	25	1	28	16 = 36·3 °/。
	(2)	14	29	1	32	12 = 27·3 °/。
Abdominal, .	(1)	—	13	1	8	6 = 43 °/。
	(2)	2	8	—	4	6 = 60 °/。
Lumbar and Abdominal,	(1)	—	3	—	3	—
	(2)	—	—	—	—	—
		34	78	3	75	40 = 34·9 °/。

The results of this table are very similar to those of the preceding one; and it is a fact worthy of note that the percentage mortality taken all over is lower in the nephrectomies than in the nephrotomies.

The causes of death in the 79 fatal cases of operation for suppurative disease were as follows:—

Note.—This table does not include 42 successful cases of Nephro-lithotomy for renal calculus without suppuration.	COMBINED ABDOMINAL AND LUMBAR.		ABDOMINAL.		LUMBAR.		TOTAL DEATHS.
	Nephrotomy.	Nephrectomy.	Nephrotomy.	Nephrectomy.	Nephrotomy.	Nephrectomy.	
Shock and Collapse, . .	—	—	1	4	9	10	24
Uræmia and Suppression of Urine, ...	—	—	1	1	6	5	13
Pyæmia and Septicæmia, .	—	—	1	—	2	5	8
Peritonitis, ...	—	—	1	1	3	1	6
Hæmorrhage, ...	—	—	—	2	—	1	3
Pulmonary Congestion, .	—	—	—	—	1	—	1
Broncho-pneumonia, . .	—	—	—	—	1	—	1
Pnuemonia, ...	—	—	—	—	1	—	1
Phthisis Pulmonalis, . .	—	—	—	—	—	1	1
Coma, ...	—	—	—	—	1	—	1
Heart-clot?	—	—	1	—	—	—	1
Acute Mania, ...	—	—	—	1	—	—	1
Tetanus, ...	—	—	—	—	1	—	1
Cancer, ...	—	—	—	—	—	1	1
Cause unknown, . . .	—	—	2	3	7	4	16
Total Deaths, . .	—	—	7	12	32	28	79 } 224
Total Recoveries, . .	1	3	2	12	67	60	145
Percentage Mortality, ...							35·3 °/。

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITH CALCULUS.

	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	8. viii. '71.	Simon (Heidelberg). *Chir. d. Niere*, ii, p. 148.	F., 30	Lumbar.	Calculous pyelitis (left).	12 years.	Death on thirty-first day; peritonitis and pleurisy; left kidney atrophied, and contained 18 or 20 small calculi; sepsis.	D.	—
2	20. i. '77.	Heath (London). *Med. Chir. Trans.*, 1880-81.	F., 24	Abdominal.	Ovarian cyst.	1 year.	Dilatation of pelvis; calculus in ureter; death; peritonitis on tenth day.	D.	
3	6. viii, '77.	Dumreicher (Wien). *Holl. im. Arch. f. Klin. Chir.*, xxv, p. 224.	M., 33	Lumbar.	Calculous pyelitis of left kidney.	10 years.	Death from collapse; right kidney healthy; pyonephrosis without calculus.	D.	—
4	2. ii. '78.	Muller (Oldenburg). *Berl. Klin. Woch.*, 1880, No. 24.	M., 21	Do.	Calculous pyelitis, with hydronephrosis.	4 years.	Calculous pyelitis of left kidney.	—	R.
5	19. iv. '79	Urbaniti (Cesena). *Amer. Jour. Med. Science*, 1882.	F., 56	Do.	Calculous pyelitis.	—	Right suppurating kidney; abscess and calculus in kidney; cause of death not stated.	D.	—
6	4. xi. '79.	Bardenheuer (Cöln). *Die Drainirung*, v, p. 254.	M., 46	Do.	Calculous pyelitis, with fistula.	3 years.	Left kidney atrophied.	—	R.
7	15. iii. '80.	Czerny (Heidelberg). *Arch. fur. Klin. Chir.*, xxv, p. 862.	M., 23	Do.	Calculus in left kidney.	—	Left kidney healthy; uric acid calculus.	—	R.
8	24. iii. '80.	Lange (New York). *N. Y. Med. Rec.*, 1880, Aug., No. 6.	F., 47	Do.	Right pyonephrosis.	3 years.	Death in three days from uræmia; left kidney converted into a cyst; ureter obliterated; calculi.	D.	—
9	2. vi. '80.	Stockwell (Bath). *Med. Press and Circular*, 1880, Nov.	M., 54	Do.	Calculus and pyelitis.	14 years.	Death in ten hours; hæmorrhage from the renal vein.	D.	—

10	5. vi. '80.	Barker (London). *Centralb. fur. Chir.*, 1881, No. 2.	F., 32	Lumbar.	Calculus and pyelitis.	27 years.	Right kidney healthy; calculus in left; death in three hours from collapse.	D.	—
11	19. viii. '80.	M'Clelland (Pittsburg). *Thèse inaugurale de Hans Bolz*, Dorpart, 1883.	F., 20	Do.	Calculus and pyonephrosis, with fistula.	—	Diagnosis confirmed; persistent inguinal and lumbar fistulæ.	—	R.
12	5. x. '80.	Barker (London). *Centb. f. Chir.*, 1881, No. 2.	F., 38	Do.	Calculus and pyonephrosis (left).	7 mos.	Death in twelve hours from shock; right kidney atrophied, and containing large calculus.	D.	—
13	20. i. '81.	Péan (Brodeur).	M., 11	Do.	Pyelitis, with calculus of left kidney.	—	Kidney suppurating and calculus.	—	R.
14	7. iii. '81.	Czerny (Heidelberg). *D. Med. Woch.*, 1881, No. 31.	F., 45	Abdominal.	Pyonephrosis with calculus of right kidney.	2 years.	Kidney suppurating; hæmorrhage from section of right renal vein; kidney in form of horse shoe; death after operation from hæmorrhage.	D.	—
15	5. v. '81.	Barwell (London). *Trans. of London Congress*, 1881, ii, p. 275.	M., 18	Lumbar.	Lumbar abscess, with fistula from renal calculus.	10 mos.	Stone removed in fragments, weighing 134 grains.	—	R.
16	—	Bardenheuer (Cöln). *l. c.*, p. 267.	—	Do.	Left renal calculus.	—	Patient relieved of pain; urine normal.	—	R.
17	—	Bardenheuer (Cöln). *l. c.*, p. 267.	M., 20	Do.	Calculus and pyelitis.	—	Perinephritic abscess and calculus.	—	R.
18	14. vii. '81.	Godlee (London). *Lancet*, 1882, i, 22nd April, p. 648.	F., 57	Abdominal.	Calculus and pyelitis.	3 mos.	Death in twenty-four hours from shock; left kidney healthy.	D.	—
19	24. vii. '81.	Rosenbach. *Berl. Klin. Woch.*, 1882, No. 5, S. 65.	M., 42	Lumbar.	Pyonephrosis, with calculus.	24 years.	Right kidney atrophied, with phosphatic concretion; persistent fistula.	—	R.
20	1881,	Richet. *Revue Science Med.*, xx, p. 282.	F.	Do.	Pyelitis, with calculus of right kidney.	—	Calculus in kidney; purulent infection.	D.	—

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITH CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
21	11. iii. '82.	Thornton (London). *Brit. Med. Jour.*, 1883, i, p. 899.	F., 26	Abdominal and Lumbar.	Calculus and pyelitis.	—	Right kidney contained oxalate of lime calculus and blood-clot.	—	R.
22	15. iii. '82.	Thornton. *l. c.* and *Lancet*, 1882, ii, 25th Nov., p. 893.	F., 58	Abdominal.	Renal calculus.	16 years.	Stone in ureter; right kidney pyonephrosed.	—	R.
23	14. x. '82.	Wright (New York). *N. Y. Med. Jour.*, 1883, i.	F., 34	Lumbar and Abdominal.	Wandering kidney, with stone.	9 years.	—	—	R.
24	1882.	Israël. *Deutsche Med. Zeit.*, 1883.	F., 21	Lumbar.	Pyelitis, with calculus of left kidney.	—	Pyonephrosis; death from phthisis pulmonalis.	D.	—
25	28. xii. '82.	Baker, W. N. (London). *Brit. Med. Jour.*, 1883, i, 20th Jan., p. 123.	M., 17	Do.	Calculous pyelitis, with fistula.	5 years.	Left kidney contained calculi and abscesses.	—	R.
26	23. iv. '83.	Bergmann (Berlin). *Bolz. Dissert. Dorp.*, 1883, p. 48.	F., 43	Do.	Calculous pyelitis (right).	15 years.	Calculus in ureter of right kidney; pyonephrosis; death in three hours from collapse; left kidney hypertrophied.	D.	—
27	4. v. '83.	Israël. *Berl. Klin. Woch.*, 1883, No. 45.	F., 28	Do.	Pyonephrosis, with peri-nephritic abscess and stone in ureter.	1½ years.	Death in 34 hours from pyæmia.	D.	—
28	9. vi. '83.	Ollier. *Rev. de Chir.*, 1883.	F., 22	Do.	Pyelitis, with suppuration of right kidney.	—	Kidney suppurating.	—	R.
29	x. '83.	D'Antona *Centlb. f. Chir.*, 1883, No. 48.	F., 37	Abdominal.	Pyonephrosis of left kidney—calculus.	—	Obstruction of ureter with calculus.	—	R.

30	24. x. '83.	Morris. *Med. Times and Gaz.*, 1884, ii, 29th Nov., p. 757.	M., 35	Lumbar.	Renal calculus, with fistula.	2 years.	Left kidney healthy; right kidney normal, but containing calculus.	—	R.
31	13. xi. '83.	Davy (London). (Private.)	M., 56	Do.	Calculous pyelitis.	10 years.	Stone impacted in left ureter. Cancer of ureter and left lumbar glands; discharged 10th Jan., 1884; died 15th Jan., 1884.	D.	—
32	24. xii. '83	Macewen (Glasgow). *Brit. Med. Jour.*, 1884, i, 19th Jan, p. 123.	M., 18	Do.	Renal calculus.	—	Three renal calculi in right kidney, with abscesses; left kidney normal.	—	R.
33	13. iii. '84.	Kosinski. *Centb. f. Chir.*, 1884, No. 42.	F., 32	Abdominal.	Calculous pyonephrosis.	—	Interstitial nephritis, and renal calculi (9).	—	R
34	22. iii. '84.	Lawson Tait. *Birm. M. Rev.*, Sept. 1885.	F., 32	Lumbar.	Hydroneprosis of right kidney.	—	Calculus.	—	R.
35	8. vi. '84.	Bottini. *Centb. f. Chir.*, 1885, No. 12.	M., 27	Do.	Calculous pyelitis, with lumbar fistula.	12 years.	Right kidney contained two calculi.	—	R.
36	2. vi. '84.	Thornton (J. K). *Intern. Med. Cong. Rep.* ii, 154.	F., 49	Abdominal.	Calculous pyelitis.	—	Hundreds of small uric acid calculi removed along with kidney.	—	R.
37	24. vi. '84.	Elder (Nottingham). (Private.)	F., 40	Lumbar.	Do.	—	Diagnosis confirmed.	—	R.
38	25. viii. '84.	Sonnenburg. *Berl. Klin. Woch.* 1884, No. 47.	F., 52	Do.	Calculus and pyelitis of left kidney.	—	Voluminous kidney, with calculi, and suppurating; right kidney increased in bulk, with great degeneration.	D.	—
39	8. x. '84.	Thornton. *Med. Times and Gaz.*, 1885, i, 14th Mar., p. 347.	F., 32	Abdominal.	Calculous pyelitis, with hydronephrosis.	24 years.	Ureter obstructed—three calculi in kidney.	—	R.
40	1884.	Salomoni. *Centb. f. Chir.*, xii, 1885.	F., 27	Lumbar.	Pyonephrosis and calculus in right kidney.	—	Lumbar fistula for last 12 years.	—	R.

NEPHRECTOMIES FOR SUPPURATIVE DISEASE OF KIDNEY WITH CALCULUS—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
41	1884.	Bobroff. *Wratch*, No. 42, 1885.	M., 38	Lumbar.	Pyelitis and calculus of right kidney.	—	Perinephritic abscess; kidney extirpated in fragments.	—	R.
42	2. ii. '85.	Elder (Nottingham). *Lancet*, 1. viii. '85.	F., 56	Do.	Calculus and pyelitis.	—	Diagnosis confirmed; not quite well; other kidney affected.	—	R.
43	5. iii. '85.	Walsham (London). *St. Barth. Rep.*, 1885.	F., 41	Do.	Calculus and pyelitis.	7 mos.	Calculus and pyelitis; phosphatic stone in kidney; kidney reduced to a series of thin walled cysts.	—	R.
44	14. iii. '85.	Le Dentu (Paris). *Semaine Med.*, 1885, No. 11, 18th March.	M., 39	Do.	Calculus and pyelitis of left kidney.	—	Kidney suppurating; persistence of lumbar fistula.	—	R.
45	30. iv. '85.	Polaillon. *Rev. de Chir.*, 1885.	F., 27	Do.	Calculus and pyelitis of left kidney, with fistula and wandering kidney.	—	Nephritic pains some months after operation.	—	R.
46	21. v. '85.	Billroth. *Wien Med. Woch.*, 32-34, 1885.	F., 42	Abdominal.	Calculus and pyelitis of right kidney.	—	Suppurating voluminous kidney, with calculi; death from hæmorrhage.	D.	—
47	9. vi. '85.	Péan (Brodeur).	F., 44	Lumbar.	Calculus and pyelitis of right kidney.	—	Suppurating kidney, with calculi.	—	R.
48	9. vi. '85.	Le Dentu. *Bull. de la Soc. de Chir.*, 4th Nov., '85.	M., 30	Do.	Calculus and pyelitis of left kidney.	—	Suppurating kidney; persistence of lumbar fistula; death from pyæmia; no septic infection.	D.	—
49	—	Savage (Birmingham).	—	Langenbuch's operation	Pyonephrosis.	—	Pyonephrosis, with three large calculi.	—	R.
50	25. vii. '85.	Trelat. *Bull. Soc. Chir. Par.*, 1885.	F., 26	Lumbar.	Hydronephrosis of left kidney.	—	Calculus found in kidney and cystic disease.	—	R.

51	1. viii. '85.	Briddon (New York). *Med. News*, 30. i. '86.	F., 36	Abdominal.	Pyonephrosis.	Few mos.	Kidney contained multiple abscesses, and an umbrella-shaped calculus, weighing 125 grains.	D.	—
52	17. ix. '85.	Shepherd. *New York Med. Rec.*, 12. xii. '85.	F., 24	Lumbar.	Calculous pyelitis.	2 years.	Recovery in four weeks; kidney completely destroyed.	—	R.
53	30. xi. '85.	Edis (London). (Private.)	F., 30	Abdominal.	Pyonephrosis 12 months, right kidney.	—	Pyonephrosis; over a dozen renal calculi, various sizes; cystic kidney; ureter dilated.	—	R.
54	31. xii. '85.	Pêan (Brodeur).	F., 33	Lumbar.	Calculus and pyelitis, with suppuration of left kidney.	—	Suppurating kidney; extirpation of kidney; suppression of urine.	D.	—
55	25. i. '86.	Pêrier (Brodeur).	F., 29	Lumbar.	Calculus and pyelitis, with suppuration of right kidney.	—	Suppurating kidney, with calculi; death, cause not stated.	D.	—
56	22. ii. '86.	Edis (London). (Private.)	F., 34	Abdominal.	Pyonephrosis 4 years; symptoms of calculus.	—	Pyonephrosis, with large calculus Y-shaped impacted in pelvis of kidney; death, cause not stated.	D.	—
57	vi. '86.	Macewen (Glasgow). (Private.)	F., 24	Lumbar.	Pyonephrosis and renal calculus.	1 year.	Kidney filled with abscesses; one calculus in pelvis, and several in renal substance.	—	R.
58	—	Godlee (London). (Private.)	F.	—	Calculus in kidney.	—	Large mass of calculus previously removed.	—	R
59	9. xi. '86.	Maclaren (Carlisle). (Private.)	M., 13	Lumbar.	Removal of left kidney; suppuration of left kidney.	2 years.	Calculous pyelitis; wound nearly healed; patient up; much pus in urine; calculi passed occasionally.	—	R.
60	1886.	Marsh (H). *Lancet*, 5. ii. 1887.	F., 25	Lumbar and Abdominal.	Movable kidney with calculi.	—	Kidney atrophied and contained two calculi.	—	R.
61	15. ii. '87.	Terrier, *Rev. de Chir.*, Paris, 1887, v, 342.	F.	Abdominal.	Hydronephrosis.	—	Pyelitis and calculus in ureter.	—	R.

LECTURE V.

Tubercular Disease of the Kidney, general remarks. Varieties—(1) *Acute miliary tuberculosis.* (2) *Chronic localised renal tuberculosis: its etiology, pathological anatomy, and mode of extension discussed and illustrated by cases, preparations, and statistics. Physical signs, examination of urine, diagnosis, prognosis, and treatment.*

Traumatic Lesions—(1) *Injury to kidney without external wound:* (a) *bruises and* (b) *lacerations.* (2) *Injuries with penetrating wound:* (a) *without displacement,* (b) *with prolapse.* (3) *Internal and external injuries of the pelvis and ureter, producing* (a) *pseudo-hydronephrosis and* (b) *fistulæ. Lesions considered systematically, and illustrated by cases and quotations.*

GENTLEMEN,—I find it will be convenient to divide this lecture into two distinct parts—the first being devoted to the discussion of tubercular disease of the kidney, and the second to certain traumatic lesions which call for surgical interference.

You will remember that in last lecture I limited my remarks to suppurative disease of the kidney unassociated with a specific virus, such as we have in syphilis and tuberculosis. The distinction of these diseases from others of an inflammatory nature may seem arbitrary and somewhat unscientific, seeing that the separation of specific from non-specific poisons is, with our present knowledge, by no means easy. I use the term specific, however, in its older rather than in its more modern sense. Pathologists have differed amongst themselves respecting the precise position which the lesions we are about to consider should occupy in a scientific classification. Some have placed both gummata and tubercular formations amongst the tumours, others have regarded them as essentially inflammatory lesions, while a third section of observers have created a separate class of new formations —the infective granulomata, including tubercular and syphilitic formations, along with those of leprosy, lupus, glanders, and actinomycosis. Where the syphilitic and tubercular formations should be placed depends entirely upon our definition of the term tumour. Being accustomed to define tumours as neoplasms which have a tendency to persist and increase without inclining either to develop into the tissue of their matrix or to decay, I cannot regard such hyperplasias as those associated with syphilis and tuberculosis to be related so closely to tumours as to deserve only to be placed in a sub-class. They seldom show a tendency to persist and increase, and frequently, I might say always, incline to decay (tuberculosis) or develop into a higher tissue (syphilis). Being due to the irritation of a virus, they have a strong analogy to other inflammatory formations, and in their structure also are similar to the connective tissue hyperplasia of inflammation. Tubercular new formations differ from simple inflammatory growths, however, in their tendency to undergo caseation, while in syphilitic neoplasms the growth, although it may break down at one part, has usually a tendency to develop connective tissue at another.

With these general remarks on the purely theoretical question of classification, we will now proceed to discuss one of the most serious forms of disease to which the kidneys and urinary tract are liable—viz., tubercular disease.

This disease of the kidney manifests itself in two very distinct forms—viz., acute miliary tuberculosis and chronic localised tuberculosis, or scrofulous kidney.

The former is due to an infective process, giving rise to a general eruption of tubercles in the various organs of the body. The tubercular virus is conveyed to the kidney by the blood-vessels, and hence the favourite seat of the disease is in the cortex, where the little growths appear as small semi-translucent greyish streaks surrounded by a darker zone of deeply injected renal tissue. These miliary nodules are frequently arranged in rows following the direction of the vasa interlobularia, and present an appearance closely resembling minute hæmorrhagic infarctions. This regular arrangement is seen in a few cases, but in most of those which have come under my notice the tubercles have been distributed without any very evident relationship to the arterial supply of the kidney, while in other instances the infective process has appeared as if limited to an area supplied by a single branch of the renal artery. The small tubercles just described consist of altered portions of kidney tissue, appearing as small circumscribed areas infiltrated by leucocytes, which are at first clear and tolerably well defined. At the same time the epithelium of the tubules undergoes fatty metamorphosis, the tubules become compressed by the abundant connective tissue formation around them, and the infiltrated leucocytes and epithelium swell up and undergo caseous necrosis, so that ultimately, should time permit, the whole infected area becomes disorganised. This degenerative change begins at the centre of the tubercle and extends towards the periphery, where the micro-organisms are most abundant. In some parts these little tubercular masses coalesce, and unitedly form patches of considerable size, which, in the first instance, are usually situated at the union of the cortex and medulla, but on account of the remarkable tendency tubercular inflammation has to spread, they may ultimately involve a considerable portion of the kidney. In such masses the blood-vessels become occluded by thrombi, and as a consequence further necrosis ensues. In this form of renal tuberculosis the disease is generally confined to the parenchyma of the kidney, and does not extend to the lower urinary tract.

Secondary or miliary renal tuberculosis is always associated with tubercular disease in other parts, and is a disease which attacks children more frequently than adults. It may be preceded by tubercular formations in any part of the body, but the most common precursor of renal miliary tuberculosis is phthisis pulmonalis. Next, in order of frequency, comes tubercular meningitis, while in a few instances tubercular affections of lymphatic glands, joints, bones, the prostate gland, and the bladder have been named as the primary disease. The mode of infection may either be by the blood, as in cases in which the renal lesion is preceded by phthisis pulmonalis, or, when the lower urinary tract is primarily involved, infection may be by the lymphatics, the disease spreading in fact very much in the same way as septic inflammation in pyelonephritis. In such cases both kidneys are usually involved, but instances in which the disease is confined only to one kidney have been recorded by Israel, Lebec, and Jean.

The discovery of the presence of renal miliary tuberculosis is frequently made for the first time after the death of the patient. As the lesion does not give rise to any distinctive symptoms the disease is one which is to be inferred from the general circumstances of the case rather than definitely diagnosed. Besides, being a disease almost limited to young children, it is one for which nothing can be done surgically. I shall therefore not ask you to look at specimens, nor occupy your time by further discussion, but will now proceed to consider the chronic variety of tubercular disease of the kidney, which is of great surgical interest and importance.

In chronic localised tuberculosis of the kidney, renal phthisis, tubercular pyelitis, tubercular pyelonephritis, or strumous disease of the kidney, the principal seat of the lesion is at the apices of the papillæ, in the calices, or in the pelvis of the kidney, and from hence, partly by the blood stream, and partly by the lymphatic channels, the material virus is carried within the substance of the kidney. The primary focus becomes occupied first by miliary tubercles, and subsequently by a caseous mass. In the course of a few weeks or months this mass forms an irregular softened area, which by progressive peripheral infiltration spreads inwards. At the same time by infection, new, and to the naked eye, apparently independent nodules develop in the tissue around, while in more remote parts of the kidney, and in the mucous membrane of the pelvis an eruption of opaque white nodules may appear. In recent cases these diminish in size and number the more distant they are from the primary focus, but when the disease is of long standing the individual nodules cannot be distinguished. The constructive process, which has just been described, is rapidly followed by a destructive one. The tubercular nodules, having attained a certain size, undergo caseous necrosis, break down, and when in the pelvis of the kidney they become replaced by a tubercular ulcerating surface, or if within the renal parenchyma they are transformed into irregularly globular cavities. These, as they enlarge, become elongated, and assume a pyriform shape, and approaching the cavity of the renal pelvis rupture into it. As the destructive process extends from within outwards, greater and greater portions of the renal substance become involved, until finally, the whole of the medulla and a large portion of the cortex may be destroyed. This leads to the formation of a large cavity. But besides the encroachment on the renal tissue by tubercular disease, dilatation and sacculation of the organ may be caused by a blocking of the ureter, ultimately producing a tubercular pyonephrosis, which sometimes, when the other kidney is free from disease, destroys all vestige of urine secreting tissue. Should only one organ be involved the kidney may, by a drying up of the contents of the pyonephrosis, become converted into a shrivelled, putty-like mass. But if the ureter be permeable the urine washes away the collections of *debris* and the products of suppuration, which present a characteristic appearance, to be referred to presently.

Associated with tubercular disease of the kidney, there are usually more or less specific inflammatory changes in the mucous membrane of the pelvis, ureters, and bladder. The lesion in these parts may either precede or follow the disease of the kidney. Generally, the affection of the conducting and collecting portions of the urinary tract is brought about in the following way:—The primary focus being situated in the medulla of the kidney, the disease spreads into the renal substance, the tubercular material breaks down, discharges by bursting into the pelvis, and flowing into the bladder, in its course infects the mucous membrane. The infection also may extend upwards from the bladder to the kidney on the opposite side. When the ureter becomes so involved it is gradually transformed into a more or less rigid tube with thickened walls. The inner surface becomes irregularly ulcerated throughout its entire extent, and covered by a greyish yellow discharge, which may assume the appearance of a false membrane, while the submucous connective tissue increases in bulk, so that the lumen of the duct may be obliterated. To external appearance the ureter may seem, however, as if it were dilated, as in hydronephrosis, but on more minute examination, the walls will be found to be remarkably thickened and the lumen of the canal reduced rather than increased.

The bladder is usually contracted, its muscular coat hypertrophied, and the mucous membrane indurated. In the ureters and bladder the tubercular process begins by the formation of tubercles in the mucous membrane, and these breaking down form in a typical manner the so-called lenticular ulcers, characterised by a flat base covered by caseous matter, and sharp ragged borders, within which little miliary nodules are situated. The ulcers are at first circular, usually superficial, their edges are slightly raised, and surrounded by a pale anæmic zone set in the deeply hyperæmic mucous membrane. In the bladder these ulcers frequently coalesce, forming larger ones of variously irregular forms. Their favourite seat is—probably on account of the mode of infection—the trigon and fundus of the viscus.

Besides other ten specimens from the Royal Infirmary Museum, I have here two which illustrate beautifully the tuberculous process as observed in the kidneys, ureters, and bladder. In showing you the first specimen, I will read to you Dr. Coats' report in the *Catalogue of the Western Infirmary Museum.* He writes:—

"There is in this case a general and advanced tubercular disease of the kidney and ureter on the right side, and a somewhat advanced hydronephrosis, with limited tubercular disease of the kidney, along with dilatation and slight tuberculosis of the ureter on the left side. The course of events has probably been a chronic local tuberculosis of the left kidney, with extension down the ureter to the bladder, tuberculosis of the bladder extending to the orifice of the left ureter, and causing obstruction there with resulting dilatation of this ureter and hydronephrosis. An extension to this kidney has subsequently occurred. The right kidney is somewhat enlarged in outline, and is converted into a series of cavities with a ragged irregular internal surface and caseous wall. The ureter is greatly thickened and lined with irregular caseous material. The mucous membrane of the bladder presents almost continuous superficial ulceration. The terminal part of the left ureter is greatly thickened and hard, while the ureter above is much dilated, but generally thin walled, and with only here and there a localised thickening. The outline of the left kidney is considerably greater than that of the right, and it presents internally a dilatation of the pelvis and calyces, the internal surface of which, in the upper two-thirds, is smooth and of the usual appearance of hydronephrosis. In the lower third, however, there is an irregular surface, sometimes with shaggy projections and a hard caseous lining of some thickness. There is a considerable thickness of kidney tissue between the distended calyces and the surface, and in this tissue a number of small abscesses are visible.

"The case was one of a boy aged 9, who had an abscess behind the bladder, which was opened."

The second specimen is equally instructive. It was removed from a man aged 29, who died in the Royal

Infirmary from tubercular disease of the lungs and of the urinary tract:—

The preparation shows the condition of the bladder, ureters, and right kidney in this case. In the bladder there is very abundant ulceration, hardly a trace of mucous membrane remaining. The ulcers are usually about ¼ inch in diameter, closely set and circular, and in the fresh state there was on the surface a yellow material, frequently coated with a gritty deposit. In the left ureter (which is cut at its middle and suspended in the preparation) there are very numerous ulcers, covered with a firm gritty deposit. The right ureter is less ulcerated than the left. The right kidney, which is preserved in the preparation, has the usual characters of tubercular disease. There are several large irregular cavities, whose walls are formed of a rough breaking down tissue. The cavities communicate with one another and with the pelvis, and contain a soft yellow debris. The left kidney presented similar characters, but in an even more advanced stage. It is also worthy of note that the same form of ulceration has spread from the bladder into both vasa deferentia for a distance of about two inches. The lungs presented the usual appearances of somewhat advanced phthisis with cavities.

The patient was a man aged 29. The history chiefly related to the chest affection, but it is noted that towards the end of micturition there was often a sudden stoppage of the stream with a kind of burning pain at the glans penis. He sometimes had pain over bladder. He is said to have been in good health till 18 months before death.

The comparative frequency of tubercular disease of the kidney may be judged by the following statistics quoted by Roberts:—

"Embracing both primary and secondary deposits—the latter being, especially in children, by far the most frequent—out of 1,317 tuberculous subjects examined in the Pathological Institute of Prague (out of a total of 6,000 bodies), tubercle in the kidney was found 74 times, or in the proportion of 5·6 per cent of tuberculous subjects (*Prager Vierteljährsch.*, bd. 1, p. 1, 1856). Among 315 tuberculous children, Rilliet and Barthez found tubercle in the kidneys 49 times, or in the proportion of 15·7 per cent."

Dickinson also alludes to the relative frequency of renal tuberculosis in children and in adults, and in a table compiled from the *post-mortem* records of St. George's Hospital and the Hospital for Sick Children, he shows the frequency of tubercular formations in the kidney and other organs in 600 *post-mortem* examinations—the subjects of 300 being under the age of 12 years, the subjects of the other 300 being of the age of 12 years and upwards. Of the former, 49, and of the latter 17, suffered from tubercle in the kidney. These results correspond so closely with those of Rilliet and Barthez that there can be little doubt that renal tuberculosis in one form or another is specially a disease of early life. But whether the renal lesion is a primary or a secondary one is not shown in the statistics to which I have just referred.

Dickinson does not distinguish the two forms, miliary and caseous; for "the miliary," he says, "becomes caseous as they enlarge, so that although in some cases there may be only one or only the other, yet they are continually intermixed and inseparable, as different results of the same process." From the surgeon's standpoint it must appear, however, very important to distinguish between a disease which involves the whole system and another which primarily attacks an individual organ or part of an organ, even although they are histologically the same pathological process.

With the distinction just referred to in view, Morris shows, by an examination of the records of the Middlesex Hospital, that of the 44 cases of tubercular kidney met with in 2,610 necropsies, 29 were miliary (secondary) and 15 strumous (primary).

Of the 29 cases of miliary tuberculosis, 18 were males and 11 females, and in 28 out of the 29 both kidneys were diseased; while in the 15 cases of primary renal tuberculosis (9 males and 6 females), both kidneys were diseased in 8. Another point worthy of note is the different periods of life at which the two forms of disease occur.

In the miliary (secondary) tuberculosis—

12 cases occurred in persons under 10 years of age.
8 " " between 10 and 30 years.
6 " " over 30 years.
3 " " whose age is not stated.

In the scrofulous (primary) tuberculosis—

No cases occurred in persons under 11 years.
5 " " between 11 and 30 years.
7 " " over 30 years.
3 " " whose age is not stated.

I have not sufficient material at my disposal to present you with statistics based upon the distinction between primary and secondary renal tuberculosis, and I doubt if the pathological records of hospitals are of great value to the surgeon, seeing that what he desires is not so much information respecting the relative proportion of the two varieties of tuberculosis, observed *post-mortem*, as an idea of the length of time the disease may remain local, and how frequently the kidneys are affected separately and together. The conditions found after death do not always show clearly the course of events, and certainly do not prove that local renal tuberculosis does not exist, even though at the necropsy a disseminated tuberculosis may be discovered. From a study of the natural history of the disease one would infer that secondary tuberculosis should affect both kidneys, whereas the primary or scrofulous variety should be limited to one side, at least for a considerable time. You can easily understand why in pulmonary tuberculosis, where the facilities for infection are great, one lung should not remain long free from disease after the other has been invaded, but in the kidney the anatomical arrangements are so different that one might reasonably expect a considerable period to elapse between the invasion of the primary focus and the extension of the disease to the organ on the opposite side.

Respecting the etiology of primary tuberculosis little is known. The circumstances under which it may be acquired involve all the conditions of defective hygiene, together with some local exciting cause. Not only is it necessary that the specific infective virus should be introduced into the system, but it is also requisite that in the body there should be a part, the vitality, or resisting power of which has been so reduced as to permit of a rapid multiplication of the pathogenic micro-organisms. But how this local impairment is brought about we know practically nothing.

The physical signs of primary renal tuberculosis are seldom very pronounced, as the lesion rarely produces sufficient swelling to be palpable during life.

Sometimes, however, the swelling attains considerable dimensions and occupies the greater part of one side of the abdomen. In about one-fifth of the cases recorded, and in the majority of those operated upon for strumous disease, the tubercular pyonephrosis was discoverable by palpation during life. Increase in the bulk of the kidney, while it must be regarded as an important sign of disease, is one which, when present in connection with a tubercular lesion, usually indicates that the disease has so far advanced as to cause diminution of the lumen of the ureter or other obstruction to the flow of the urine. It is important also to ascertain whether or not the swelling is limited to one side. This may be done by palpation and percussion in some cases, while in others the only reliable mode of testing the extent of the disease is by catheterising the ureters.

The physical characters of the urine are, in some instances, such that one can with certainty state that the urinary tract is the seat of a tubercular lesion, while in other cases the excretion may be, to no appreciable extent, altered from the normal. Before destructive processes commence within the renal pelvis or substance, traces of albumen or even a few red blood corpuscles may be detected, but when the tubercular deposit has commenced to break down and evacuate into the ureter, the quantity of albumen is increased, the urine is liable, after a time, to become alkaline, and along with greater or less quantities of *débris* of renal tissue, pus appears. To the distinguishing characteristics of the urine in strumous pyelitis I have already referred (p. 91-92).

As the disease advances the odour of the urine, as a rule, becomes more and more offensive, the fluid deposits large quantities of mucus and triple phosphates, and on examination is found to be highly albuminous. Occasionally, while the urine is pale and of low specific gravity, there may be evidences of retention on the diseased side, as shown by increase in the renal swelling, with perhaps indistinct fluctuation and pain and general constitutional disturbance, or there may be complete suppression, death being ushered in by uræmic symptoms.

In addition to the diagnostic points which I have already indicated, the detection of the tubercular bacillus in the urinary *débris* is of great value. The method which I have employed most successfully is as follows:—Allow a quantity of urine to stand in a conical glass in a cold place, for not more than six hours, and having placed a small quantity of *débris* in a glass of three-quarters per cent salt solution, select the largest and most consistent particles. Having placed a small fragment on a clean cover glass, it should be spread out into a thin layer by pressing another cover glass against it between the finger and thumb. On separating the cover glasses, a thin film of *débris* will be found adhering to each. The glasses must be air-dried and then the films may be more firmly fixed by drying over a spirit lamp or in front of the fire. The cover glasses are then placed in, or still better, floated upon (with film side downwards) a solution of anilin magenta or a staining fluid of gentian-violet. When the film has become sufficiently stained the colour may be abstracted from all structures other than the tubercular bacilli by passing the cover glass through a 25 per cent solution of nitric acid. The action of the acid may be arrested by carefully washing the specimen in pure water. When examining the urinary *débris* for tubercular bacilli, it is necessary in most cases to prepare at least half a dozen specimens. Should the bacillus be present it will be recognised by a magnifying power of 750 diameters, as a minute rod-shaped body, coloured according to the nature of the staining fluid employed. They are from three to seven micro-millimetres long, may be straight, but are more frequently curved, or bent upon themselves at an obtuse angle, are frequently beaded, and occur in bundles or singly. From the urine the micro-organisms are not easily cultivated, as putrefactive bacteria contaminate the culture and destroy the specific bacilli. Koch, however, states that he has succeeded in cultivating tubercular bacilli from cases of tubercular pyelitis.

Besides the detection of the tubercular bacillus, it is necessary to determine whether the disease is on one or both sides. I have several times had occasion to examine by urethral catheterisation cases of tubercular pyelitis, in which it was considered of importance to determine the extent to which the disease had spread. I will, with your permission, refer briefly to two of these. In the first case, the result of the examination clearly showed that the lesion was limited to one kidney, whereas in the second the evidence was in favour of the disease being bilateral. The former was that of a woman, aged 26, who was admitted into the Glasgow Royal Infirmary, suffering from symptoms of tubercular pyelitis of the left kidney, first under the care of my colleague, Dr. Alex. Robertson, who asked me to make the examination. Subsequently, the patient was transferred to the surgical ward of Mr. H. E. Clark, who successfully operated by lumbar nephrectomy (table, page 342, Case No. 33). Previous to making the examination by the urethral catheters it was noted that the urine was decidedly below the normal in quantity, had a specific gravity of 1015-1020, contained albumen and pus, the former in larger quantity than could be accounted for by the amount of the latter.

The examination of the urine separately from the two kidneys gave the following results:—

	RIGHT.	LEFT.
Appearance, .	Clear and pale in colour; on standing for 6 hours, only a deposit of mucus and a few epithelial cells.	Dark straw colour; clouds on standing for 6 hours, with an abundant deposit.
Reaction, . .	Neutral.	Alkaline.
Albumen, . .	Very slight trace.	1·805 per cent.
Hæmoglobin, .	None.	1 in 8,000.
Tube-casts, . .	None.	None.
Microscopic exam.,	Slight deposit of epithelium and mucus; no blood, pus, or tube-casts.	Abundant deposit of pus, with triple phosphates; a few blood corpuscles and spheroidal epithelium; no tube-casts.

No tubercular bacilli could be discovered in the deposit from the urine, but after the kidney was removed it was found to be characteristically tubercular.

The second was a private case placed under my care by Professor Gairdner, for the purpose of having an operation performed for her relief. The circumstances of the case pointed clearly to tubercular pyelitis, but whether or not the opposite kidney was healthy had not been determined before the patient was placed under my care. Before deciding to operate I catheterised the ureters, and found that the deposit from both kidneys contained pus and tubercular bacilli. The question, therefore, of operative interference was no longer entertained, and the patient died from the disease a few months after.

Vesical irritation, shown by frequent and painful micturition, is a frequent and almost characteristic symptom in tubercular disease. Morris mentions the case of a man under his care who passed water with much pain and spasm on an average 160 times in the 24 hours; and at the *post-mortem* examination there was found scrofulous disease of the kidneys and ureter, the bladder having only quite recently become affected. It is on account of the liability of the bladder to secondary ulceration and the tendency to decomposition of urine that vesical symptoms are so frequent and urgent. In fact, it may be said that tubercular pyuria seldom exists for a considerable period without some evidence of bladder irritation.

The local and constitutional symptoms of primary renal tuberculosis in the early stage are practically those of suppurative pyelitis in an exaggerated form, and in the former these symptoms are conjoined with those of sub-acute or acute cystitis.

I have described in last lecture the symptoms of suppurative nephritis; but whether it is due to a tubercular or a simple inflammatory lesion is, in the early stage, very difficult to determine. When the disease is advanced the diagnosis is much easier, both on account of the characters of the urine being more distinctive, and also because of the general signs of tuberculosis being more marked.

It is to the diagnosis of tuberculosis in the early stage that we must especially direct our attention, seeing that in its later development the aid of the surgeon is of little avail.

As soon as destructive processes have become established in the tubercular mass, the urine furnishes important information. The presence of continuous large quantities of pus in the urine and the appearance of granular *débris*, mixed with broken masses of tubercular material containing tubercular bacilli and shreds of connective tissue, indicate the nature of the disease. In tubercular disease the discharge of an organised deposit such as I have just described is almost always continuous—not interrupted, as in cases of renal calculus; and frequently when, in the former disease, the escape of pus is suddenly prevented, it is only a too certain indication of the fatal termination.

As the disease advances bladder symptoms become more prominent, and may be distinguished from those of vesical calculus by the circumstances that the pain is diminished rather than increased when the bladder is empty, and there is seldom an escape of blood with the last drops of urine. In tubercular disease frequent micturition is invariably accompanied by pain, which commences to be severe about the middle of the flow, and, increasing towards the termination, subsides almost immediately the bladder is empty. It is not, as a rule, characterised by pain in the penis, nor, as in cases of vesical calculus, by sudden stoppage in the flow of water. The temperature of the patient is generally from two to three, or even four, degrees higher in the evening than in the morning, or there may be intermittent periods of fever, lasting for several consecutive days. The patient also suffers from profuse night sweats, emaciation, loss of appetite, and exhaustion comparatively early in the course of the disease.

The diagnosis between calculous and tubercular disease is sometimes difficult, but may generally be made out by the following circumstances:—In calculous pyelitis the purulent stage is slowly developed, and is usually preceded by occasional attacks of slight hæmaturia. Indeed, in many cases of renal calculus the appearance of blood in the urine is the first circumstance which attracts the attention and alarms the patient. In calculus the urine also passes through a stage during which there is an increase in the quantity of mucus, and this stage is succeeded by the appearance of pus, the quantity of which slowly increases; and while these changes are taking place, even through a protracted period, it is remarkable how well the general nutrition of the body is maintained. In tubercular disease, on the other hand, the purulent stage develops early, the pus being constantly present in almost unvarying large amount, and is accompanied from the beginning by a degree of emaciation, by a careworn expression, by evening exacerbations of fever, and by rigors, by drenching night sweats, and an interference with appetite seldom witnessed in calculous pyelitis.

Tubercular disease is readily distinguished from malignant tumours of the kidney or renal pelvis by the circumstance that in these diseases the urine seldom contains much pus or *débris*, and if abnormal at all, it is from the presence of blood which may be found in large quantities.

The extension of the inflammatory process to the ureter, bladder, and lower urinary tract is strong if not unequivocal evidence of its tubercular nature. In inflammation arising in the course of calculous pyelitis or pyonephrosis, the conducting and collecting portions of the urinary system are seldom seriously implicated; whereas in the strumous disease not only are those structures involved, but by a process of infection the generative organs may become invaded—in the male the vesiculæ seminalis, the vas deferens, the epididymis, or the testicle; and in the female, the vagina and the ovaries. An examination, therefore, of these parts may assist the diagnosis in doubtful cases.

Miliary tuberculosis of the kidney, secondary to lesions in other organs, it need scarcely be said, is not capable of diagnosis; and even though it did afford symptoms referable to the kidney, and thereby aroused a suspicion of its presence, nothing could be done to relieve the patient.

In tuberculosis the prognosis is most unfavourable, and is especially grave when the disease is not limited to one kidney, but extends to the urethra, the ureter, the bladder, or the other kidney. When, however, the lesion is limited to one kidney, without implicating the lower urinary tract, the affected organ may be destroyed by suppuration; or, being dried up into a firm caseous mass, it becomes practically harmless, while its neighbour undergoes compensatory hypertrophy. This favourable course of events is, however, unfortunately rare; but while this is so, on the other hand it must be admitted that in many instances a considerable time is permitted to elapse between the commencement of the primary renal tuberculosis and the invasion of other parts.

It is by making an early diagnosis and by taking advantage of this interval, that the surgeon can hope to save or prolong the life of his patient. Should catheterisation of the ureters be possible, and the examination of the urine prove the disease to be limited to one kidney, an exploratory incision should be made in the lumbar region, and free exit given to the tubercular *débris*. This operation has now been employed in 20 cases, with 6 deaths (3 males and 3 females). In 6 instances the minor operation of incision was followed by excision, and of these, 2 cases died, and the remaining 4 recovered. The following table shows the general result.

NEPHROTOMIES FOR TUBERCULAR DISEASE.

	Males.	Females.	Recoveries.	Deaths.
Lumbar, . . .	7	12	13	6 = 32 °/.
Abdominal, . .	1	—	1	—
	8	12	14	6 = 30 °/.

In the fatal cases the causes of death were as follows:—Two patients died of amyloid disease, one from shock following the operation, one from exhaustion, another died with an increase in the symptoms of the tubercular disease, accompanied by epileptiform attacks, and in the sixth case the immediate cause of death is not stated.

Whether or not nephrectomy should be preceded by nephrotomy must be determined by a careful consideration of the facts of the individual case.

If the disease is limited to a small area, and has formed only one cavity which can be easily drained, nephrotomy may be practised in the first instance, and a hope may be even entertained that no further operation will be required. But should this favourable prospect not be realised, and the wound continue to discharge, then excision of the kidney must be resorted to, otherwise the prolonged suppuration may cause death by inducing amyloid infiltration of the other kidney. This danger, together with the possibility of the tubercular disease extending to other parts, may give rise to reasonable doubt as to the wisdom of leaving the tubercular material to separate by suppuration alone. The caseous matter should therefore be removed as far as possible during the operation, by scraping, or by the application of the cautery.

When the tubercular disease extends over a large area of the kidney, nephrectomy should be performed as a primary operation. There being no prospect of saving any renal tissue, or of comparatively rapid spontaneous evacuation of the tubercular material, little can be gained and much may be lost by delay. Therefore if the general health of the patient be such as to permit nephrectomy being performed, it should be resorted to at the earliest possible date, when it has been shown, or the strong presumption is, that the disease is limited to one side. In many instances the advanced condition of the tubercular lesion prohibits the operation. In the treatment of this disease it is only by a very careful selection of cases that the surgeon has any hope of bringing credit to his art. Dr. Cole (*British Medical Journal*, 5th August, 1882, page 208) records a case of tubercular disease of the kidneys worthy of consideration, from the circumstance that had not the patient rapidly become worse just at the time fixed for the operation, nephrectomy would have been performed, and the patient relieved of the only urine-secreting tissue of which he was possessed, the non-tubercular kidney consisting only of dilated calices "even although during life no evidence existed that the left kidney was diseased." Notwithstanding the great difficulty in judging of the cases suitable for operation nephrectomy has now been performed many times with signal success. From an examination of the tables of nephrectomy for tubercular disease (page 340), it will be observed that although the mortality is very high, namely 36·3 per cent, a sufficient proportion of the patients have recovered from the operation, and enjoyed a prolongation of life, to justify the surgeon in extending his sway where medical treatment is unavailing. The following table shows the general result.

NEPHRECTOMIES FOR TUBERCULAR DISEASE.

	Males.	Females.	Recoveries.	Deaths.
Lumbar, . . .	13	13	16	10 = 38·5 °/ₒ
Abdominal, . .	—	7	5	2 = 28·6 °/ₒ
	13	20	21	12 = 36·3 °/ₒ

Of the 33 cases operated upon, in 26 the lumbar operation was performed (13 males, with 5 deaths, and 13 females, with 5 deaths), and in 7 female cases, the abdominal one was adopted, with 2 deaths.

The causes of death in the 12 fatal cases were as follows:

	Abdominal.	Lumbar.	Nos. of Cases.
Shock and Collapse, ...	1	4	7, 8, 14, 16, 21
Septicæmia, ...	—	1	24
Uræmia, ...	1	1	15, 17
Hæmorrhage, ...	—	1	1
Vomiting, ...	—	1	29
Cause unknown, ...	—	2	6, 25
	2	10	

In many of these cases the patient recovered from the operation and lived for a few months, but in how many instances a cure, in the proper sense of the term, was effected, I have been unable to determine. While there is no reason to deny that in the kidney tubercular disease may remain local, and be completely removed by operation, the circumstance that the natural tendency of tubercular disease is to simultaneously attack several organs, renders the prospect of ultimate recovery less hopeful in this disease, than in other suppurative lesions, notwithstanding that the immediate mortality from the operation of excision is not much higher in the tubercular (36·3 per cent) than in some of the non-tubercular suppurative affections.

[Suppurative disease without calculus, 33·3 per cent. Suppurative disease with calculus, 36 per cent.]

In those cases in which operative interference is not considered advisable the treatment must be symptomatic. The general constitutional treatment of renal phthisis belongs, however, to the domain of the physician rather than to that of the surgeon, who can practically do nothing in the way of relieving local symptoms by instrumentation. On account of the great tendency of the urine to become alkaline, and to decompose, washing out of the bladder is in most instances contra-indicated.

INJURIES OF THE KIDNEY AND URETERS.

As I announced to you at the commencement of this lecture I now intend to devote the remaining portion of your time to-day to the consideration of certain diseased conditions of, or injuries to, the kidneys, pelves, and ureters, calling for surgical treatment, which can be more conveniently discussed here than in any other part of the course.

Notwithstanding the protected position which the kidneys occupy in the body, they are liable like other organs to injury by external violence, while the ureters have been, in a considerable number of instances, torn or wounded by the surgeon during operations for disease of other organs, or as a consequence of unfortunate employment of midwifery forceps. Injuries to the kidney without external wound were observed and recorded by the early surgical writers long before the present day and previous to the question of active surgical interference being entertained as a possible mode of treatment.

All the classical works on diseases of the kidney referred to this subject. Gittler published a special work, *De renum vulnere, et qui huic succedit, cruento mictu,* Leipsic, so long ago as 1596, and Rayer gives an excellent *résumé* of the literature of the subject up to his time, together with an account of 10 cases of wounds, and 13 cases of contusion and rupture of the organ. In the *Deutsche Zeitschrift für Chirurgie*, vol. x, 1878, Maas gave a most interesting account of an experimental enquiry into the effect of artificial rupture of the kidney in animals, and he also has collected 72 cases of injury to the kidney, in which he showed the great danger of the accident, by revealing the circumstance that out of that number 34 patients died. To the statistics of Maas, E. O. Otis has added 27 cases, which occurred between the years 1879 and 1887, and from these combined figures you will find that of the 98 cases recorded there were 50 deaths.

Between the time when Gittler wrote and the present many valuable contributions have been published, in which interesting cases have been cited both from civil and military practice. Ravaton (*Chirurgie d'armee*, 1768), Chopart (*Des Maladies des Voies Urinaires*, 1791), Morgagni, Rayer, Hévin, and Laub, are the more important early authors, while within the last few years a large amount of information has been recorded by many able writers on the subject.

Injuries to the kidney and ureter may be conveniently classified as follows.

I. Injuries without any wound of the parietal wall:—(*a*) Bruises of the kidney without rupture of its tissue; (*b*) Lacerations of the kidney.

II. Injuries with a penetrating wound of the abdomen:—(*a*) Without displacement of the kidney; (*b*) With prolapse of the kidney into or through the wound in the parietes.

III. Internal or external injuries of the pelvis or ureter, producing—(*a*) Pseudo-hydronephrosis; and (*b*) Fistula, which may communicate—1st, Externally in the lumbar or inguinal regions; or, 2nd, With the cavity of the uterus or the vagina.

With this classification in view I will now proceed to consider these lesions.

Injury to the kidney may be produced in a great variety of ways. Sometimes the force acts directly against the abdominal wall, while in other instances the rupture, laceration, or contusion of the kidney is produced in an indirect manner. The passage of the wheel of a vehicle over the lumbar region, a blow from the pole of a carriage or a car buffer, a fall against a sharp edged body, or a blow from a falling mass, may directly cause a laceration or contusion; whereas, on the other hand, a fall from a height in which the patient alights upon his feet may, by causing an acute bending of the spine, lacerate the kidney transversely. To a case of this kind I have already called your attention (page 88).

This bending of the lumbar spine forcibly in any direction may either cause a laceration of the kidney tissue or lead to a separation of the organ from its vessels and ureter.

When the injury is severe, a rapidly fatal result may follow. In relatively few instances, however, does death result from primary hæmorrhage. A fatal result ensues more commonly from secondary hæmorrhage, collapse, perinephritic abscess, peritonitis, or, should the laceration be of such a kind as to allow an escape of urine into the tissues the patient may die with symptoms of extravasation.

The immediate results also depend upon the nature and extent of the injury to other viscera, and upon the circumstance whether or not the other kidney is involved.

The immediate danger of a bruise of the kidney without rupture of the surface of the organ is not great; but, as a result of the injury, inflammation is apt to be set up, so that ultimately the entire organ may be destroyed. Berounbioux, Bienfait, and Poland narrate cases in which extensive suppuration around the kidney succeeded bruises in the lumbar region. Such a condition is usually indicated by slight and temporary hæmaturia, deep seated pain, fever with rigors, swelling in the lumbar region, and all the other symptoms of renal or circumrenal suppuration.

In more severe injuries—namely, in those where the kidney, besides being bruised, is also torn—the first danger is death from collapse, either as a consequence of the concussion or from loss of blood. Externally there may be but little ecchymosis to mark the site of the blow, even although there is extensive laceration of the kidney.

Should the patient survive the danger of death from the cause I have just referred to, he still runs considerable risk of peritonitis, either as a direct consequence of the violence or from extravasation of blood and urine into the peritoneal sac; and, at a more remote date, the injury may give rise to suppurative nephritis or perinephritic abscess. When the rupture of the kidney is confined to the anterior aspect of the organ, the escape of blood and urine is most apt to find its way into the peritoneum, as in such cases the peritoneal covering of the kidney is usually also torn. On the other hand, if the rupture be limited to the posterior surface, extravasation occurs into the cellular tissue surrounding the kidney, and sets up suppurative inflammation of a very acute and dangerous kind. In some such cases what has been termed acute hydronephrosis developed; Taylor, Rawdon, and Godlee have each recorded cases in which considerable collections of urinous fluid have formed around the kidney as a consequence of injury. The writer last named published three interesting cases in the *Clinical Society's Transactions*, vol. xx, in which abdominal cysts followed injury. In one of these the ureter was believed to be ruptured. The following account of one is given by Mr. Godlee:—

"J. R., æt. 23, a valet, was admitted, under the care of my colleague, Mr. Beck, on 13th July, 1885 (No. in hospital register, 1,420), having been knocked down on that day and run over by a heavy waggon as he lay on his back, the wheel passing over his abdomen from the right hip to the left hypochondrium. He was suffering from shock on admission, and vomited the contents of the stomach, flecked over with streaks of bright arterial blood. There was considerable pain all over the abdomen. A drop of blood was found at the end of the catheter when the water was drawn off. On this and the following two days, as he was unable to pass his water, it was drawn off, and was on each occasion found to be smoky; but after this it was passed naturally and was normal. Vomiting of bilious matter, not continued nor excessive, lasted till the 18th. The temperature rose to 100° on the second day, and gradually mounted to 101·8° on the sixth day. After the eighth day it did not rise to 100°, but it remained over 99° till the day before his discharge, 29th July, sixteen days after the accident. He became slightly jaundiced during his stay in the hospital, but left it feeling fairly comfortable, and apparently without any tumour or dulness in either flank.

"On 12th August, a fortnight after his discharge, he came back, telling us that since that time he had been occasionally sick after taking solid food, and had suffered slightly from diarrhœa. We found him pyrexial, with a temperature of 100° to 101·8°, with the abdomen slightly but uniformly distended, and giving no signs of free fluid nor of a localised cyst. There was pain, however, in the hypogastric region and the left flank. He was put upon spoon diet, and the vomiting did not recur. Hot fomentations were applied to the belly, and the symptoms referred to this region subsided. There was no trouble of any kind with the water. In about four days the temperature came down almost to normal.

"Between the date of admission and 10th September, nearly a month, he was kept mostly in bed, and for a considerable part of the time on spoon diet, as it seemed clear that vomiting was on more than one occasion started by giving him solid food and allowing him to get about. Ultimately, however, this restriction was relaxed, and the vomiting did not reappear. In the meanwhile a tumour developed itself, projecting slightly below the margin of the ribs on the left side, dull on percussion (the dulness extending in the axilla to the level of the nipple), and apparently pushing the heart up, for marked pulsation was apparent in the second intercostal space.

"On 10th September an aspirator needle was passed through the seventh intercostal space a little in front of the line of the posterior axillary fold, and so, no doubt, through the attachment of the diaphragm. It entered a cyst, and 7 ounces of turbid fluid were drawn off, containing a mere trace of urea (·01 per cent), a certain amount of albumen, and showing, under the microscope, blood corpuscles, some indefinite granular cells, and some flat epithelium.

"On the following day it is noted that the heart's apex was beating in the third space; that dulness in the back began at the eighth rib, and extended forwards as far as the sixth rib in the posterior axillary line; that in front of this there was stomach resonance as high as the fifth rib on the mid-axillary line; and that no tumour was to be felt below the ribs. The intercostal spaces were collapsed.

"Four days after the aspiration (14th September) the physical signs were the same as before the fluid was drawn off. About this patient there is little more to be said. He gradually improved in general condition, though suffering occasional attacks of sharp pain in the abdomen, modified apparently by position; but he had no more actual sickness. The temperature, which rose to 100° the day after the aspiration, came down on the following day to normal, and remained so until his discharge on 9th October. There were still signs of unnatural distension of the stomach, the tympanitic note varying in extent, but sometimes reaching the third interspace. The dulness in the back and axilla did not alter, but breath sounds could be heard over the dull area. The intercostal spaces were again collapsed, and no tumour was to be felt in the abdomen.

"He has kept well since, though he appeared the other day at the hospital complaining of some pain in the abdomen, again of a dragging character, due, I believe, to a left inguinal hernia, for which he was supplied with a truss.

"It seems almost useless to speculate upon the exact nature of the injury in this case. I do not think that the fluid was in the pleura, though it is not possible to prove the contrary. I think it most probable that it was contained in a cyst above the kidney, and resulted from a laceration of the organ, and that by pressure on the stomach it gave rise to the troublesome gastric symptoms, and also, as it extended backwards, it pressed the diaphragm against the ribs, and so caused the dulness in the back and axilla. The possibility of the existence of a diaphragmatic hernia was discussed, but the idea was discarded."

The symptoms of ruptured kidney vary according to the character and extent of the injury. There is usually, but not always, evidence of contusion in the lumbar region. Sometimes the ecchymosis of the external parts is but slight, while the laceration of the kidney is severe; and, on the other hand, violent bruising of the soft parts in the lumbar region may be present without any injury to the kidney. Hæmaturia, as a symptom of laceration of the kidney, has been already discussed (page 87), so that it is not now necessary for me to say more than a few words on the subject, with special reference to exceptional cases.

In cases where the kidney is bruised, without laceration of its tissue, hæmaturia may be present for a few days after the accident, but is not usually prolonged or severe, nor may the presence of the colouring matter of blood in the urine closely follow upon the injury. Its appearance may indeed be delayed for hours or even days through a blocking of the ureter by a coagulum. In the more severe lacerations of the kidney the urine is usually highly coloured and scanty, and blood appears in the first quantity of urine passed after the accident. The hæmaturia may not be constantly present, and may vary in amount from time to time, or it may not appear at any time in the whole course of the case; consequently its absence must not be taken as an indication that the kidney is free from injury. Supposing the ureter to be completely torn across, or the kidney divided throughout its whole thickness, the great probability is that the blood will escape into the tissues surrounding the injured organ, rather than by the ureter and bladder. On the other hand hæmaturia may be a prominent symptom after injury without the kidneys being injured in any way. I well remember a case which came under my notice twelve years ago. The patient, a lad of 15 years, by occupation a carter, was leading his horse and a heavily laden cart up a steep hill; walking backwards in front of the horse he suddenly slipped, and one wheel of the cart passed obliquely over his pelvis and right lumbar region, without causing any fracture of bone. When brought into the Western Infirmary, he complained of great pain in passing urine, which was highly stained with blood. For some time the hæmaturia was believed by the late Dr. J. G. Lyon to be due to a rupture of the kidney, but on more careful examination it became abundantly evident that the escape of blood arose from an injury of the urethra close to the neck of the bladder, which led finally to the formation of a urethro-rectal fistula.

The next objective symptom of importance is the presence of a fulness in the flank corresponding in position to the kidney. This swelling is partly due to the injury of the abdominal parietes, but may be increased by the extravasation of blood and urine into the adipose capsule of the kidney, or by a collection of fluid within the renal pelvis, resulting from a blocking of the ureter by blood clot. Although in a few instances a palpable fluctuant swelling may develop soon after the accident, in the way I have just mentioned, in most cases nothing further than a general fulness can be detected during the early stage. Pyonephrosis, hydronephrosis, or perinephritic abscess may, however, develop later on, and give rise to a well defined swelling. Evidences of fluid collecting within the abdomen may manifest themselves a few hours or perhaps days after the injury has been inflicted; in such circumstances the fluid is more likely to be urine than blood. The position of such a swelling will depend upon the situation of the laceration.

Suppression of urine is commonly observed after injury to the kidneys, and, as may be naturally inferred, is more likely to occur when both organs are involved, than when the violence has acted only on one. Indeed it is doubted by some writers if such a condition exists without both kidneys being injured in the first instance. In fact it may be said that this unfavourable indication of injury is nearly always limited to those cases in which the blow has been delivered so as to bruise both kidneys, and may be due either to interference with the escape of urine through the lower urinary tract, or to a thrombosis of the renal vessels. In either case the patient becomes comatose, and death follows rapidly.

The subjective phenomena met with as a consequence of injury to the kidney are necessarily modified by the amount of violence to which the organ has been submitted. Generally there is excessive shock and vomiting, due, in part no doubt, to the violence applied to the parts around the kidney, but also in a large measure to the renal lesion. Pain, referred to the lumbar region, and radiating down the ureters, to the lower part of the abdomen, along the lumbar nerves, to the testicle, and upper part of the thigh, is almost a constant symptom of laceration of the kidney. In character the pain is dull, aching, increased by a deep inspiration, or exertion of the abdominal muscles, and commonly associated with marked retraction of the testicles.

When there is obstruction to the escape of urine, through plugging of the ureter by blood clot, the pain is greatly increased, and approaches more closely in character that of renal colic. In other instances the suffering of the patient is increased from the bladder becoming distended with blood clot, which causes a constant desire to micturate, an act which cannot be performed without the assistance of the surgeon, who may be called upon to give relief by breaking up the clots formed in the bladder; or in order to relieve the patient, cystotomy may require to be performed.

Tenderness in the lumbar region on pressure with the hand is very characteristic of laceration of the kidney when associated with the symptoms I have just described, namely, vomiting, hæmaturia, fulness in the flank, excessive shock, retraction of the testicle, and ecchymosis of the skin in the region over the kidney.

After what I have just said, in conjunction with the observation made in a former lecture (page 87), little now requires to be added on the subject of diagnosis. But in illustration of the difficulties one has sometimes to contend with I may quote the following.

Three years ago an instructive case came under my notice in private practice. A boy, aged 15 years, fell a distance of 12 feet, and alighted on his side, which struck violently against the edge of a packing-box. When I saw him he was unconscious, and the only facts I could arrive at were the history of a fall, the circumstance that there was ecchymosis over the right eye, and in the left lumbar region half way between the lowest rib and the crest of the ilium, and the presence of a quantity of blood in the urine. The lad remained unconscious for two hours, but with the exception of severe pain in the head for a few days he had no bad symptoms. The hæmaturia continued, however, and on more minute inquiry I found that the urine had, previous to the accident, "been red when passed," and when the patient had recovered from the injury of the fall I discovered for the first time that he had a small papilloma in his bladder, from which blood continued to flow at irregular intervals. In this case from my inability to obtain information respecting his past history, I at first believed the hæmorrhage to be from the kidney, which I thought had been injured by the fall, but subsequent investigation showed that in this assumption I was entirely wrong. It will therefore be seen that while hæmaturia is one of the most reliable symptoms of contusion or laceration of the kidney from traumatic causes, cases of injury in the lumbar region may coexist with hæmorrhage, without these circumstances being related to one another as cause and effect.

The prognosis of laceration of the kidney is always grave. The ultimate result depends upon the extent of the injury to other parts, as well as upon the amount of renal laceration and contusion; but, taking the kidney lesion by itself, it may be said that the chances of recovery are in a direct ratio to the extent of the rupture —when superficial, repair may take place within a comparatively short time—when deep and extensive, little hope can be held out of a favourable termination. But while this is so in the large majority of instances, a few cases of recovery after severe laceration of the kidney have been recorded. Morris quotes a case published by Athol Johnson in the *Med. Chir. Trans.*, vol. xxxv, p. 55, of a man, aged 38, who suffered from rupture of his liver and right kidney, together with fractured seventh cervical vertebra, and died, from the spinal injury, three weeks after the accident. At the *post-mortem* examination extensive rupture of the right lobe of the liver was discovered, and several ruptures on the anterior surface of the right kidney were found to be healed.

The next traumatic lesions demanding our attention are penetrating wounds of the kidney, which may or may not be associated with prolapse of the organ.

Several cases have been published in which the kidney protruded through the abdominal wall, and from a study of these it will be seen that the prolapse may either be partial or complete. Mr. Vernon, in *St. Bartholomew's Hospital Reports*, 1866, reports a case in which the lower portion of the right kidney protruded through a wound of the abdominal walls, immediately above the crest of the right ilium; the wound also penetrated to the pelvis of the kidney, and the patient passed urine mixed with blood by the urethra and also by the wound in the soft parts. The case ultimately recovered. Brandt (Case 4), records the case of a man, aged 25, who was stabbed in the lumbar region, the wound causing profuse hæmorrhage. Following the injury the patient suffered from a severe cough, as a consequence of which a hernia of the kidney was produced. The kidney was deeply wounded on its convex aspect, and from the wound a quantity of alkaline fluid escaped, which contained renal epithelium, but no urea. Nephrectomy was performed on the 7th June, 1873, and by the 23rd of that month recovery was complete. A somewhat similar case (Case 8), is reported by Cartwright (*Lancet*, 1880, vol. i, p. 403), a third one is published by Marvaud (Case 3), and a fourth by Otis (*Beck: Chirurgie der Schussverletzungen*, s. 543, 1872).

Mr. Cartwright gave an account of his case at the Royal Medical and Chirurgical Society, in the course of a discussion on "Nephrectomy by Abdominal Section," and, as reported in the *Lancet*, said:—

"Some years ago, when in the Yang Tse river in China, he was shown by the doctor of an American vessel, also lying at anchor there, a specimen of a kidney. It had protruded from a wound in the loin, and had been dressed, according to Chinese fashion, with a mixture of bird's dung, saliva, &c.; and when the man was seen by the doctor the organ was in a state of putrefaction. Mr. Cartwright's acquaintance thereupon removed the mass, after which the patient, who had simply taken a pipe of opium during and after the operation, disappeared. He returned, however, in two or three weeks' time, and, as showing his appreciation of the services rendered him, brought with him another man suffering from cancer of the tongue."

Penetrating wounds of the kidney are met with mostly in military practice, as a consequence of sword, bayonet, lance, or gunshot wounds, which, if situated in the lumbar region, may be followed by protrusion of the organ. When in front, the injury to the kidney is almost necessarily associated with injury to other abdominal organs and the peritoneum. Such injuries have been carefully studied by the older military surgeons, and Sir Astley Cooper, John Bell, Hunter, Ackerley, and many others have contributed their share of information on the subject. By the earlier writers wounds of the kidney were regarded as highly dangerous, if not necessarily fatal. This opinion can easily be accounted for when we remember that most of the examples met with by them were cases in which the cutting instrument reached the kidney anteriorly, by penetrating through the abdomen. In its course the weapon produced lesions of the intestine; and so besides, by opening the peritoneum in two places, added the risk of extravasation of urine within the abdominal cavity to the danger of death from renal hæmorrhage. How different are the opinions held at the present day! The surgeon now incises the kidney with as much freedom as any other tissue, and almost with as little risk so long as the organ is not the seat of suppurative disease.

Wounds of the kidney other than those produced by the surgeon are generally described as marked by great pain, usually, but not always, confined to the lumbar region. This severe pain is probably due to extravasation of urine into the tissue around the kidney, as, in cases of operation with free drainage, the patient seldom suffers much inconvenience. The amount of pain must not, therefore, be accepted as of high diagnostic value. The symptoms most to be relied upon are hæmaturia and the escape of urine through the abdominal wound. The former may be present, and appear immediately after the injury has been inflicted, or may even be so copious as to cause clots to form in the ureter, bladder, or urethra. But while the hæmorrhage is commonly free at first, it generally within a few hours rapidly diminishes. Under two very different conditions blood may fail to appear in the urine—first, in those cases in which the wound is so superficial that it does not penetrate to the pelvis of the kidney; and second, in those instances in which a large vessel is divided, and the blood escapes into the tissues around the kidney rather than by way of the bladder. On the other hand, even although the renal pelvis is opened and no large blood-vessel wounded, blood may be effused so rapidly into the abdomen that the blood pressure in the kidney is diminished. Morris calls attention to this circumstance, and quotes a case mentioned by Morgagni in which a man was stabbed by a knife which penetrated the right side of the thorax between the ninth and tenth ribs, and after passing through the diaphragm, pierced the liver and the right kidney from the anterior to the posterior surface. Great hæmorrhage ensued, and the patient died before any blood found its way into the bladder.

The appearance of urine in the lumbar wound is a fact of the greatest diagnostic importance, and clearly indicates that either the pelvis of the kidney or the ureter has been penetrated. Urine may not, however, escape through the lumbar wound for some time after the injury; indeed, cases are on record in which it was not observed for days, or even weeks, after the wound was inflicted. Such cases are, however, exceptional, and, as a rule, it may be stated that if the renal cavity has been pierced, the excretion of the kidney escapes through the wound in the loin within 24 or 48 hours after the accident, unless the external lips of the wound have become united, an eventuality not unlikely to occur, and one fraught with great danger to the patient on account of the likelihood of the retained urine becoming extravasated, and inducing perinephritic suppuration. Having commenced to flow through the external wound, the danger is that the urine will continue to escape by the fistula thus established rather than by the natural channel. This is, however, a less serious event than healing of the external wound without simultaneous repair of the renal lesion.

At the Midland Medical Society, on 7th March, 1883, "Mr. Jordan Lloyd showed, for Mr. West, a kidney which the latter had removed through a lumbar wound four days previously. The patient, a boy aged 15, received an abdominal injury in November last. This was followed by hæmaturia, the development of a lumbar tumour, pus in the urine, and pyrexia. In December the aspirator drew off 55 ounces of purulent fluid from the kidney; this was repeated a week later, and followed up by a lumbar incision and the insertion of a drainage tube. Eighty ounces of purulent ammoniacal fluid daily passed through the tube. As the patient was rapidly emaciating, nephrectomy was performed. The kidney measured 8 inches in length, 4 inches in breadth, and 3 inches in thickness, weighing 16 ounces."

The subjective symptoms of penetrating wounds of the kidney depend upon their mode of production, and upon whether or not other important organs have been injured along with the kidney. When the wound is inflicted by the surgeon—for example, in the removal of renal calculus—the constitutional disturbance is comparatively slight so long as antiseptic precautions are attended to, and all circumstances that may lead to retention or extravasation of urine avoided. When the wound is the result of accident or assault, the symptoms largely depend upon the direction in which the wound is inflicted and the nature of the weapon employed. Under the circumstances just referred to it is a rare occurrence to meet with an uncomplicated wound of the kidney. This is easily understood when you consider the limited area through which a weapon must pass in order to reach the kidney without at the same time wounding other parts.

When the wound is inflicted from behind, and there is not free exit for discharges, the danger of perinephritic abscess is great, evidence of which may show itself within a few hours or days. The symptoms and dangers of this condition have already been referred to in a former lecture (page 216).

If the wound be inflicted from the front it is certain to involve the peritoneum. The primary danger under such circumstances is that the escape of blood and urine into the peritoneal cavity will set up peritonitis, which is almost certain to terminate fatally within a short time. To refer to the symptoms which indicate such an occurrence is unnecessary; all that I desire at present is to indicate to you in a general way the dangers which are to be apprehended.

Injury or wound of the ureter or pelvis may result from damage during an operation on other abdominal viscera, it may be a consequence of violence without injury to the abdominal walls, or it may be associated with a penetrating wound. By consulting the tables of operations (page 343), it will be seen that occasionally urinary fistulæ are formed between the uterus or vagina and the ureter, by the use of midwifery forceps during delivery. The operation of nephrectomy for such a condition has been performed by Zweifel (6), Czerny (9), Stark (10), and Credé (11), and the same operation has been performed by Simon (7), Le Fort (12), Starck (13), Bœckel (20), Billroth (17), and Albert (5), for fistulæ resulting from wounds of the ureter during the operations of hysterectomy or ovariotomy. Such accidents are, however, fortunately of rare occurrence, and do not demand much attention at present.

The ureter may be injured without a penetrating wound of the abdominal wall. Mr. A. E. Barker (*Dict. of Pract. Surg.*, Heath, vol. i, p. 864), narrates a case of a child lately under his care in the University College Hospital (Table, p. 344, Case 15). The following account of the case is given by Mr. Barker:—

"This patient, a boy of 3 years and 8 months, was run over by a cab in August, 1884, the wheel passing across just above the right iliac crest, and leaving extensive bruising of the parietes. At first nothing was to be made out but this bruising and some hardness of the side; then, some days later, a swelling with all the characters of hydronephrosis was felt on the right side. This was aspirated, and 45 ounces of fluid were drawn off with all the characters of urine, but containing (as was to be expected of urine secreted under pressure), only a small percentage of urea (0·5 per cent); it also contained albumen. This aspiration was repeated on six occasions at intervals of about a week, with practically the same result. The *symptoms* upon which the diagnosis was based were—first, the nature and position of the injury, then the absence of severe shock, then the presence of two small worm-like clots in the urine first passed, not followed by any bleeding, and lastly the formation of a fluctuating tumour in the renal region, dull on percussion, of a distinctly rounded form, with the liver above and the colon in front of and internal to it; finally, by the result of the exploratory aspiration, which gave exit on each occasion to fluid with all the characters of urine and a definite amount of urea. This urea was present in very small amount so long as the sac was a closed one, but as soon as a drainage tube was introduced and the fluid allowed to drain off without any obstruction, the percentage rose to 1·7 for many days. Mr. Barker proved the accuracy of his diagnosis by excising the kidney, which at once arrested the flow and relieved the child from all his distressing symptoms. In this case the urine was poured out into the areolar tissue behind the peritoneum, and there formed a large sac for itself, bounded by plastic inflammation. The wound of the ureter appears to have been not far below the pelvis of the kidney, the lower end of which was found, on excision, to be covered with granulations and phosphatic matter. The pelvis was healthy. The urine might, in another case, be poured out into the abdomen, being limited by lymph to a definite sac, or the torn end might be closed by clot or plastic material and the pelvis of the kidney be distended; or, finally, the last condition might be produced by simple bruising of the ureter, without destruction of its continuity."

Another case is reported by Mr. R. J. Godlee, in the *Clinical Society's Transactions*, vol. xx.

"W. W., a boy æt. 7 (No. in hospital register 2,450), was knocked down by a van-horse about 23rd September, 1885, and the front wheel of the van pressed against him on the right side between the iliac crest and the ribs, but did not pass over him. He remembered being pulled out and thinks that he could have walked home. He was seen by Mr. Adams Clarke, of Bushey, who found him suffering from pain in the abdomen, and administered some medicine, after which vomiting took place and the patient was relieved. He was kept in bed and fed with spoon diet for four days, after which he was able to go out for a walk and in the following week he went to school. At the end of this week he vomited after eating some fresh pork, and from that time to 28th November, about two months, he had occasional attacks of indefinite illness and gradually lost flesh.

"I saw him on 28th November, and found him with a temperature of 103°, and felt, when he was under chloroform, a distinct tumour in the left side of the upper part of the abdomen; but when he was admitted into the ward this tumour could not be made out. The next day the temperature was normal.

"He was kept in the hospital for nine weeks, during the whole of which time the temperature was slightly raised (?), being generally a little below, sometimes a little above normal. The tumour, which was sometimes only detected with difficulty, gradually became more distinct, occupying the epigastric and the left hypochondriac regions; it extended to the middle line in front and downwards to an inch above the umbilicus. There was a resonant percussion note over it, and a curious splashing sound was heard on sharply tapping it above. This was no doubt caused by the movements of the contents of the stomach, and as I was convinced that I could feel the transverse colon crossing the lower part of the cyst I did not think it safe to explore with the aspirator needle, and so the boy was sent home for a while.

"He never had any urinary symptoms and all his other functions were natural. There were no signs of tubercle. The weight remained stationary—about 3 st. 2 lbs.

"On 24th August, 1886, he came back (eleven months after the accident). The tumour had much increased in size; it occupied the whole of the epigastric region and was mesial in position, reaching, on each side, to the cartilage of the eighth rib and below to the umbilicus. It was movable from side to side and descended during inspiration. The stomach was clearly above it and the transverse colon apparently crossed its lower part as before. The boy's general health was good. His temperature was normal.

"On 25th August I made an incision through the abdominal wall 3 inches long, the lower end of which was 1½ inches from the umbilicus. There were no peritoneal adhesions. Omentum (probably great omentum) appeared in the wound and also a piece of a viscus, presumably flattened great intestine, but I am not prepared to assert that it was not the pyloric end of the stomach. I tried to pull up the omentum but failed. So I incised it above the exposed viscus and so laid bare the surface of the tumour. In doing so the small sac of the peritoneum was distinctly opened; we had thus not to do with a dropsy of the small sac.

"After protecting the abdominal cavity with sponges, an aspirator needle was inserted into the cyst and 43 oz. of turbid, whitish-yellow fluid were drawn off, neutral, sp. gr. 1015, containing ·5 per cent urea and albumen in large quantity, but no sugar. As the cyst became lax, it was seized with forceps and incised and the margins of the opening in its wall were attached by stitches to the margins of the incision in the abdominal wall, the upper and lower parts of this latter incision being approximated above and below the opening into the cyst; a drainage tube was inserted.

"The wall of the cyst was dense fibrous tissue one sixteenth of an inch or more in thickness. The lining of it was perfectly smooth and soft and fell into folds when the fluid had escaped. The cavity extended back to the spine, up to the loin, and laterally as far as the kidney on each side."

These cases just quoted to you are most interesting on account of the rarity of the accident, the accuracy of the diagnosis, and the success of the treatment adopted.

Mr. Stanley (*Royal Med. Chir. Trans.*, vol. xxvii) relates two cases of rupture of the ureter. In one instance the patient, aged 9 years, recovered, so that there was no opportunity of verifying the diagnosis; but in the other the accident terminated fatally in the tenth week, and at the *post-mortem* examination the correctness of the diagnosis was proved. In both instances the most marked diagnostic fact was the presence of a quantity of fluid behind the peritoneum (pseudo-hydronephrosis), which, when removed by tapping, was found to bear a close resemblance to urine. Mr. Poland (*Guy's Hosp. Rep.*, vol. xiv, 1869) has recorded a case very much the same as the one just described.

Injury to the pelvis of the kidney without penetration of the abdominal wall is as rare as rupture of the ureter.

Wounds of the pelvis and ureter are also on record as a consequence both of stabbing and of gunshot injury. Mr. Timothy Holmes, in his valuable paper on "Direct Wounds of the Ureter" (*Med. Chir. Trans.*, vol. lx), narrates a case of a boy, aged 13 years, in whom the ureter was exposed and wounded by a stab with a clasp knife in the back. The weapon entered the body to the right of the middle line, and on a level with the posterior superior spine of the ilium, and was followed by the discharge from the wound of a considerable quantity of clear fluid of low specific gravity and alkaline reaction. On account of the ambiguous character of the fluid which flowed from the wound, doubt was entertained in respect to its precise nature. Mr. Holmes, indeed, suggested that the fluid might be cerebro-spinal fluid proceeding from a wound of the theca vertebralis; but Mr. Reginald Harrison (*Lect. Surg. Disorders of the Urinary Organs*, 1887, page 409), in referring to this point in Mr. Holmes's case, says:—

"The case is one of much interest, and though not free from ambiguity—as, by reason of the recovery of the patient, the diagnosis was not confirmed by anatomical examination—yet the conclusion arrived at by a critical analysis of other explanations which were suggested is almost irresistible. Might not, I repeat, the altered condition of the urine which was discharged so abundantly through the loins be due to a similarly infarcted state of the blood-vessels of the kidney, as was observed in Mr. Poland's case, consequent on the proximity of the wound to this organ? Is it too Utopian to suggest that nature provides for a lacerated ureter by the induction of such changes in the corresponding kidney as will render its excretion the least hurtful to the tissues with which it may come in contact? I cannot help thinking—from the cases I have just referred to, in addition to another recorded in my lecture on extravasation, where a strong probability is furnished that urine which does not contain urea is incapable of producing distinctive changes in the tissues surrounding it—that we have, in the view I have advocated, the explanation that Mr. Holmes considers wanting in the following remark on his own case: 'If it could be shown that a wound of the ureter, or a lesion of that organ, could suspend the true secreting function of the corresponding kidney, while it left its percolating function intact, or even if any theoretical explanation of such a result could be given, the case would be quite clear, since the opposite kidney would have double secretive work to do, and the urine passed by the urethra would be scanty, with excess of lithates, &c.' I have thus ventured to make a suggestion in reference to a point in connection with these cases which has hitherto failed to receive a satisfactory explanation. Pathological investigation has worked out all the facts connected with this lesion. I have merely speculated as to how these facts may be applied."

In addition to the arguments just quoted from Dr. Harrison's admirable lectures, I may ask you to recall to mind the circumstances attending Brandt's case of prolapse of the kidney with a deep wound penetrating through the renal substance into the pelvis. In this case the fluid, although it was known to flow from the cavity of the kidney, was found to differ materially from normal urine in that it contained no urea and only a small quantity of inorganic salts. In point of fact it was almost identical in composition with the fluid that escaped from the lumbar wound of Mr. Holmes' patient, and which led that eminent surgeon to suggest that the fluid was of cerebro-spinal rather than of renal origin.

Thornton has also reported two cases (Nos. 18 and 22, table, page 345) in which nephrectomy was required in consequence of wounds of the ureter.

In the first of these the left ureter was cut in performing a very difficult ovariotomy, and the accident was not discovered till the day following, so that in the meantime the peritoneum and its contents were flooded with urine from the renal end of the cut ureter. "The urine however was healthy and the case thoroughly aseptic, and the urine flowed away through a drainage tube into antiseptic dressings, and did no harm. The peritoneum did not even look red when I opened it at the end of 24 hours to search for the ureter; this is a suggestive experience with regard to the treatment of rupture and incision of the bladder. I found the ureter without trouble and fastened it out through the loin." In the second case Dr. Thornton made a mistake in diagnosis, "believing a retro-peritoneal or mesenteric cyst to be a renal," and only found out his mistake after he "had irreparably damaged the ureter." After nephrectomy both patients made a good recovery.

Before passing from the consideration of injuries to the ureters may I briefly refer to a condition which sometimes follows these traumatic lesions—namely, stricture of the ureter? When the ureter is injured there is always the danger that the cicatricial tissue, formed during the process of repair, may undergo contraction, thereby impeding the flow of urine from the pelvis, and so induce a hydronephrosis. In discussing the etiology of acquired hydronephrosis, in a former lecture (page 108), I showed you how adhesions and bands might cause dilatation of the renal pelvis, but I did not then include cicatrices of the ureter from injury.

In the *Pathological Society's Transactions*, vol. xxiii, Dr. Pye Smith records an interesting case in point. The patient, aged 24 years, was admitted into Guy's Hospital suffering from a large hydronephrosis of the left kidney, caused by a traumatic stricture of the ureter, which after death was so contracted as not to admit a small probe. The stricture was believed to be caused by an injury to the ureter from a kick by a horse, received two years previous to the patient's death. Two cases of a similar nature are reported by Mr. John Croft (*Clinical Society's Transactions*, vol. xiv), and by Dr. Reginald Harrison in his Lectures.

Gun-shot wounds of the ureter are very rare. Probably the best known case on record, and the only undoubted one, is that of the Archbishop of Paris, who was wounded in the lumbar region during the Revolution in 1848. The ball entered the lumbar muscles close to the spine, on the right side, and fractured the transverse process of the third lumbar vertebra; the ball then passed through the body of the vertebra, divided the cauda equina, then, passing to the left side, severed the ureter close to the left kidney, and ultimately became impacted in the left psoas muscle. Before death, which occurred eight hours after the injury, the Archbishop suffered great pain and depression, nausea and vomiting; no blood or urine was found in the bladder, but a quantity of both flowed from the wound. The diagnosis of such an injury is extremely difficult, as it is liable to be mistaken for a wound of the kidney. But on account of its great rarity further reference to it is unnecessary.

During this course of Lectures I have had occasion to show you how fistulous openings may become established between the cavity of the kidney or the ureter and other parts, as a consequence of disease. For example, I mentioned that accumulations of fluid within the kidney might escape externally through an opening in the loin, or in the groin; also, by rupturing into one of the hollow abdominal viscera they might establish a fistulous communication with the colon, stomach, small intestine or rectum. Operations upon the kidney are liable to be followed by fistulæ. For example, in nephrotomies for cystic disease, hydronephrosis, suppurative disease of the kidney, or tubercular disease, the wound in the loin may continue open for a considerable time. These conditions have been already considered. The only fistulæ which I have therefore now to deal with are those produced by traumatic causes.

The varieties of fistulæ, respecting which I at present wish to say a few words, are those caused, on the one hand by the unfortunate use of midwifery forceps, and on the other by the misadventures of the surgeon. From the table of nephrectomies (page 343) it will be seen that extirpation of the kidney has been frequently adopted for the purpose of curing urinary fistulæ resulting from accidents such as those I have just mentioned. This operation was first resorted to by Simon, in 1869, for the cure of a distressing case of urinary fistulæ, resulting from ovariotomy. All other forms of treatment having failed to give the patient relief, the advisability of performing nephrectomy was duly considered, and after carefully conducted experiments upon animals, Dr. Simon decided to operate, and by the success of this operation, designed and performed upon definite physiological principles, he gave an enormous impetus to renal surgery. Since the time just referred to nephrectomy has been performed 14 times for fistulæ arising from similar causes; to some of these I shall refer presently, under the subject of treatment.

We now proceed to the consideration of the treatment of the traumatic lesions of the kidney to which your attention during the latter portion of this lecture has been directed. It is self-evident that the surgical procedure will be largely guided by the precise character of the injury to the kidney and to other organs. Our enquiry must, however, necessarily be devoted to the kidney lesion only, and, in speaking of treatment, I shall follow nearly the same order as I have adopted in reviewing the etiology and pathology of the subject.

In cases of bruises and lacerations of the kidney without a penetrating wound the first consideration in treatment is absolute rest in bed, and, should the patient be restless and the pain severe, opium must be administered freely. In order to check hæmorrhage from the kidney, hypodermic injections of ergot may be tried, or internal styptics, such as gallic acid, iron, alum, and acetate of lead and opium may be employed. In otherwise healthy individuals, free bleeding from the arm has also been resorted to in order to reduce the blood pressure and obviate the danger of hæmorrhage into the peritoneum or perinephral tissue.

When the symptoms indicate that the laceration of the kidney is severe, and there is danger of the patient bleeding to death, either from the escape of blood by the ureter or into the tissue surrounding the kidney, the surgeon is justified in cutting down upon the kidney and removing it. The urine should be drawn off by a catheter in order to ascertain the presence of blood. When the quantity of blood is large, there is always the danger of clots forming and obstructing the flow of blood and urine from the ureter or the urethra. If the former accident occurs, the urine, instead of being stained with blood, becomes suddenly clear, and at the same time there may be evidence of its retention within the renal pelvis or around the kidney. Few cases of this kind have been treated by operation, surgical interference being reserved more for the later development of the case—namely, when suppuration has become established. It seems to me that much good might be done by early operation, both in cases of severe hæmorrhage from the kidney and in those instances where the ureters become blocked by blood-clot.

In the *British Medical Journal*, vol. i, 1883, p. 108, Mr. Bennett May has recorded a most interesting and instructive case in point. The patient, a man aged 24 years, was admitted into the Queen's Hospital, Birmingham, in a state of general collapse, with a scarcely perceptible pulse of 126. He complained of having been kicked and assaulted, and on examination the abdomen was found to be strongly retracted, and there was great tenderness in the left loin and hypogastrium. He was unable to micturate, and when a catheter was passed, what appeared like pure blood flowed from it, and blood continued to be present in the urine in greater or lesser amount until the fifth day, when it was observed to be entirely absent, but the urine was slightly ammoniacal, depositing phosphates. The following day (6th) a physical examination of the loin showed the dulness to be increased, but there was no tumour or swelling. On the morning of the seventh day after the injury the pain, which had been absent for the last two or three days, suddenly returned with great severity, and radiated down the thigh into the groin, also to the scrotum, and along the lumbar plexus. From the facts just stated—a history of an injury in the renal region, accompanied by hæmaturia, which was at first profuse, but subsequently suddenly and completely disappeared, coincident with an increase in the area of dulness and fulness in the loin and an attack of severe paroxysmal pain—Mr. Bennett May was driven to the conclusion "that probably the ureter was blocked in some part of its course by a clot, and that blood and urine, unable to escape down it, were accumulating in the loin, but whether in the pelvis of the kidney or outside in the perinephritic tissue" could not be determined.

A long needle was introduced at the outer edge of the erector spinæ, close under the last rib, and passed in a direction upwards and outwards through the substance of the kidney to its pelvis. After the needle had passed a distance of seven inches, fluid was reached and drawn off to the extent of seven ounces, and on examination was found to be identical in composition with what the patient had been passing from the bladder previously. After the tapping the pain was relieved and the patient passed blood-stained urine, but its colour was lighter than formerly. The re-appearance of blood in the evacuation showed that the obstacle to its transit had been removed by the aspiration. The hæmaturia disappeared on the twelfth day, and the patient left the hospital five days later, but subsequently (January, 1882) suffered from an attack of non-suppurative nephritis. The explanation offered of this case is that the injury to the kidney caused a small rupture of the renal pelvis, through which urine escaped into the surrounding tissue, and there became encapsuled, and by its pressure upon the ureter caused obstruction to that duct. Another explanation of the case is that the ureter was obstructed by a blood-clot. Whatever was the immediate cause of the obstruction, the fact remains that it was effectually relieved by the withdrawal of the extravasated blood and urine.

Another contingency which must be considered is the formation of blood-clots in the bladder, which may prevent the escape of urine by the urethra. This is often a source of much trouble to the surgeon as well as of suffering and danger to the patient. An endeavour should always be made in such cases to relieve the obstruction by the use of an ordinary full-sized catheter, and, should this fail, Big large catheters may be employed in conjunction with the suction bottle, to break up and extract the clot. If the means which I have just mentioned fail to relieve the patient, the surgeon has the option of two modes of procedure. He may either wait in the hope that the urine will cause a softening of the blood-clot, and endeavour to relieve the suffering of the patient in the meantime by the administration of anodynes, and the employment of hot baths; or he may at once empty the bladder by opening it from without, and for this purpose either the operation of cystotomy or that of urethrotomy may be resorted to.

Dr. Henry Rawdon has recorded in the *British Medical Journal* a case of nephrectomy for rupture of the kidney where lateral cystotomy was also subsequently performed for the relief of cystitis caused by retained blood-clot. The patient, a boy aged 12, "was admitted into the Liverpool Infirmary for Children on 7th December, 1882. The previous day he had fallen into a stone basement, a distance of about eight feet. On admission he was found to be passing blood in his urine. He complained of some pain in his right side. The only other evidence of an injury was a small bruise-mark over the crest of the ilium. The diagnosis was that rupture of the right kidney had been caused by the injury. The hæmaturia for the first few days diminished, but it subsequently increased, and was followed by acute cystitis. With the object of preventing blood from entering the bladder, on the 17th day after the injury, the injured kidney was removed by a lumbar incision, and then it was found to have been torn nearly completely across. Relief followed the operation. Subsequently, symptoms of acute cystitis again showed themselves. On the twenty-first day after the injury, and four days after the nephrectomy, lateral cystotomy was performed, when fœtid clots were removed, and a free drain for the urine was established. Relief was afforded by the cystotomy so far as the symptoms directly traceable to the bladder were concerned. The patient died on the fortieth day after the injury. The cause of death appeared to have been pyelitis and circumscribed suppuration of the left kidney, lesions probably traceable to an extension of the cystitis which had been occasioned, partly by the presence of decomposing clots, and partly by attacks of retention of urine. It was suggested that, if cystotomy had been performed earlier, the latter consequences might have been averted."

Such an operation should not be resorted to except in the most serious cases, and then only when it has become evident that no other procedure will give relief. But when this fact has once been ascertained the sooner cystotomy or urethrotomy is performed the better. To operate at a late stage only brings discredit on the operation.

I have now concluded what I have to say respecting the treatment of lacerations of the kidney during the early stage, and may pass to the discussion of how the dangers which attend the later periods are to be combated.

In cases of severe injury we must anticipate extravasation of the urine and subsequent suppuration. It is therefore incumbent upon the surgeon to make frequent and careful examinations in order to ascertain as early as possible any indication of suppuration in the lumbar region; a form of suppuration which spreads very rapidly, is productive of grave constitutional disturbance, and in most cases, if permitted to extend even for a short time, rapidly proves fatal.

In many cases of suppuration of the kidney from injury without a penetrating wound attempts have been made to relieve the patient by means of the aspirator. These endeavours, however, have seldom been successful, the cases having in most instances subsequently demanded a lumbar incision, or even nephrectomy. Free antiseptic incision made early affords the best prospect of recovery to the patient. On the incision being made the kidney should be carefully examined, and if found to be seriously injured nephrectomy must be at once performed. No good and much evil may result from postponing the radical operation.

The treatment of penetrating wounds of the kidney next calls for our attention, and may with advantage be considered according to the period of time that has elapsed since the injury was inflicted.

During the early stage danger to life arises from hæmorrhage, shock, and peritonitis. Many of the remarks I have already made in connection with the treatment of contusions and lacerations of the kidney are equally applicable to the conduct of a penetrating wound, but especially those in respect to the necessity for absolute rest, the suppression of hæmorrhage, and the removal of blood clots from the ureter or bladder. When the wound is a small one, and does not penetrate to the pelvis of the kidney, the danger of extravasation of urine is but slight; and if the wound be made aseptic, and kept in that condition, while at the same time care is taken to prevent the wound in the soft parts healing before that in the renal substance, the chances of the patient suffering from renal suppuration are reduced considerably. Should, however, the external wound be allowed to heal early in the case, any urine that may escape from the unhealed renal surface is liable to become lodged in the lumbar region, and to set up inflammatory mischief. This should be especially guarded against if there is any evidence to show that the ureter is obstructed.

Severe wounds of the kidney, or wounds penetrating into the pelvis or ureter, may demand nephrectomy at an early date after the injury, if the condition of the patient is otherwise satisfactory. When a large branch of the renal artery is severed, when the ureter or pelvis is deeply incised, or when a considerable portion of the kidney is destroyed, it is safer for the patient to have the kidney excised at once than to wait till suppuration has been established, as the circumstances attending decomposition of urine and prolonged suppuration greatly increase the dangers of an operation. When urinary extravasation has occurred without serious obstruction to the ureter, a free aseptic incision in the lumbar region may be sufficient to relieve the patient from the risk of suppuration, if performed sufficiently early, and before the urine has decomposed.

In instances in which the kidney is already the seat of suppuration, and when there is little hope of saving the organ, nephrectomy will be required.

The only conditions I have now to speak of in connection with treatment are penetrating wounds of the kidney with prolapse, and cases of obstruction to the ureter. These may be disposed of in one or two words. The measures to be adopted depend, in the first class of cases, entirely upon the nature of the injury to the kidney. If it be slight, then the organ may be replaced, and even stitched in position, as in the operation of nephrorraphy; but if severe, then the injured organ must be removed immediately. Three operations for this condition will be found in the table, page 343 (Nos. 3, 4, 8).

Obstruction to the ureter from causes not referred to in former lectures call now only for a passing notice, two cases only having been included in the table (page 345)—one operated upon by Bardenheuer (21), in which there was an obstruction to the left ureter; and another by Kreider (32), where the impediment was believed to be due to a catarrhal inflammation of the duct.

By glancing over the table (page 343) it will be seen that for traumatic lesions and urinary fistulæ, &c., lumbar nephrotomy has been performed five times without a death, for such conditions as rupture of the kidney (Nos. 19 and 26), nephritic colic (23 and 30), and obstruction to the ureter (32). Nephrectomy has been performed 27 times, and of these only in one instance was the abdominal operation employed (Case 22). Of the remaining 26 lumbar nephrectomies there were 18 recoveries and 8 deaths.

The following table shows the nature of the disease and the result of the operation:—

Disease.	Recovery.	Death.	Nos. of Cases.
Painful Kidney, . . .	1	1	1, 2
Prolapse of Kidney, . . .	3	—	3, 4, 8
Lumbar Fistulæ, . . .	4	1	5, 13, 16, 25, 31
Inguinal Fistula, . . .	—	1	12
Uterine Fistulæ, . . .	2	—	6, 11
Abdominal Fistulæ, . . .	2	1	7, 17, 28
Vaginal Fistulæ, . . .	3	—	9, 10, 20
Obstruction to Ureter, . .	—	1	21
Rupture of Ureter, . . .	1	—	15
Wound of Ureter, . . .	1	—	18
Rupture of Kidney, . . .	—	3	14, 24, 27
Wound of Kidney, . . .	1	—	29
	18	8	

Five cases died from shock or collapse (2, 12, 17, 21, 24), one from peritonitis (5), one from suppurative pyelitis (14), and in one (27) the cause of death is not stated.

The cases included in the above table differ very much in respect to the injury to which the kidney was subjected, and are too small in number to deduct any general conclusions from them. With regard however to rupture of the kidney, it is perhaps worthy of note, that in two cases in which lumbar nephrotomy was performed both patients recovered, whereas in three in which the organ was removed by the lumbar operation, the results were in all of them fatal. In contra-distinction to the fact just stated, we have the circumstance that in three lumbar nephrectomies for prolapse of the kidney through a wound in the loin, all the patients made rapid and satisfactory recoveries.

Taken all over the nephrotomies and nephrectomies for traumatic lesions of the kidney, urinary fistulæ, &c., give a percentage mortality of 28·1.

NEPHROTOMIES FOR TUBERCULAR DISEASE OF THE KIDNEY.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	15. vi. '78.	Thornton (J. K.) *Intern. Med. Cong. Rep.*, ii, 154.	F., 48	Lumbar.	Tubercular disease.	—	Diagnosis confirmed, no calculus; patient died in February, 1879.	—	R.
2	ix. '79.	Golding-Bird. (Private.)	M., 21	Do.	Renal neuralgia.	—	Minute strumous abscess; kidney otherwise healthy; died three years after from chest disease; *post-mortem*, strumous kidney.	—	R.
3	1879.	Lucas. *Lancet*, 1880, vol. i.	M., 36	Do.	Tubercular kidney and perinephritic abscess.	5 years.	Fistula remained; nephrectomy afterwards performed with good result.	—	R.
4	12. xii. '79.	Goodridge & Fowler. *Brit. Med. Jour.*, 1882, ii, p. 85.	F., 17	Do.	Strumous disease.	18 mos.	Previous tapping; death on 30th Dec. from exhaustion; kidney converted into a large sac containing a large quantity of pus and tubercular material.	D.	—
5	27. iv. '80.	A. E. Barker. (Private.)	F., 27	Do.	Tubercular kidney.	6 mos.	Right kidney tubercular, left amyloid; recovery with considerable relief; death three months later, from uræmia and amyloid disease.	D.	—
6	1880.	Baker. *Brit. Med. Jour.*, 1881, i, p. 351.	F., 8	Do.	Tubercular pyonephrosis.	1½ years.	Fistula remained; nephrectomy performed three months after nephrotomy.	—	R.
7	1881.	Duncan. *Edin. Med. Jour.*, 1881, i.	F., 32	Do.	Tubercular of left kidney.	—	Strumous disease of kidney with perinephritic abscess; death on fifth day; amyloid infiltration of organs.	D.	—
8	1881.	Barwell. *Trans. Lond. Cong.*, ii, p. 275.	F., 16	Do.	Tuberculosis with suppuration.	—	Recovered from nephrotomy, but died six days after nephrectomy which was subsequently performed.	—	R.

9	4. ii. '82.	Thornton (J. K.) *Intern. Med. Cong. Rep* xi, p. 154.	F., 26	Lumbar.	Scrofulous pyonephrosis.	—	Temporary relief; nephrectomy afterwards performed.	—	R.
10	10. iii. '82.	G. Elder (Nottingham). *Lancet*, 1882, ii, p. 567.	F., 36	Do.	Tubercular pyelitis.	—	Diagnosis confirmed; nephrectomy successfully performed 6 weeks after.	—	R.
11	1883.	Kuester. *Berl. Klin. Woch.*, 1883.	M., 30	Abdominal.	Pyonephrosis.	—	Tubercular abscess in left kidney.	—	R.
12	21. iv. '84.	Wright. *Brit. Med. Jour.*, 1885, i, p. 432.	M., 17	Lumbar.	Tuberculosis of kidney and renal calculus.	—	Recovered from nephrotomy; fistula remained; nephrectomy performed 11. xii. 1884; death on eighth day.	—	R.
13	20. iv. '85.	Lawson Tait. *Birm. Med. Rev.*, Sept., 1885, p. 98.	F., 38	Do.	Multiple abscesses.	—	General condition very bad; amelioration of symptoms; subsequent nephrectomy considered not advisable.	—	R.
14	16. v. '85.	Gardner. *Austr. Med. Jour.*, 1885.	M., 28	Do.	Tubercular abscess of right kidney.	—	Tuberculosis of both kidneys; a month later the symptoms became more marked, and accompanied by epileptoid attacks; both kidneys found tuberculous at *post-mortem*.	D.	—
15	vi. '85.	A. G. Miller (Edinburgh). (Private.)	F., 22	Do.	Pyonephrosis.	—	Tubercular pyonephrosis; died before August, 1886.	—	R.
16	3. xii. '85.	A. T. Cabot (Boston, U.S.) (Private.)	M., 23	Do.	Tubercular pyonephrosis.	—	Diagnosis confirmed; death in three months; cause not stated.	D.	—
17	v. '86.	Mayo-Robson. (Private.)	M., 35	Do.	Tubercular kidney.	3 years.	Tubercular disease of both kidneys; tubercular peritonitis; death from shock.	D.	—
18	4. vi. '86.	A. E. Barker. (Private.)	F., 7	Do.	Tubercular pyelitis.	—	Saculation with fœtid purulent accumulation.	—	R.
19	4. vii. '86.	Clark. *Glas. Med. Jour.*, 1887, i, p. 321.	F., 24	Do.	Tubercular disease.	1 year.	Nephrectomy performed on 27th Aug. following.	—	R.
20	1886.	John Duncan. (Private.)	M., 13	Do.	Tubercular abscess.	—	Diagnosis confirmed, hip-joint disease; sinus left.	—	R.

NEPHRECTOMIES FOR TUBERCULAR DISEASE OF THE KIDNEY.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	16. v. '72.	Peters. *N. Y. Med. Jour.*, Nov., 1872.	M., 36	Lumbar.	Tuberculosis of right kidney.	19 mos.	Great hæmorrhage; tubercles in vesiculæ seminalis and ureters; death from hæmorrhage in 65 hours.	D.	—
2	17. ii. '80.	Lucas (C. R.) *Trans. Lond. Cong.*, ii, p. 271.	M., 36	Do.	Tuberculous suppurating nephritis.	6 years.	Kidney suppurating; secondary hæmorrhage the seventh day stopped by perchloride of iron; previous nephrotomy.	—	R.
3	x. '80.	Mandach. *Centb. f. Chir.*, 1884, No. 35.	M., 28	Do.	Tubercular suppurative nephritis.	—	Diagnosis confirmed; two years later castration performed for tubercular disease of testicle.	—	R.
4	1880.	Raffa (A.) *Centb. f. Chir.*, 1881, No. 44.	F., 20	Do.	Tubercular suppurative nephritis of right kidney.	16 mos.	Death four months later from pulmonary tuberculosis; left kidney also tubercular.	—	R.
5	22. ii. '81.	Baker (M.) *Trans. Lond. Cong.*, 1881, ii, p. 262.	F., 8	Do.	Tubercular pyonephrosis.	1½ years.	Kidney tubercular, with purulent cavity; nephrotomy previously performed.	—	R.
6	1881.	Barwell. *Trans. Lond. Cong.*, ii, p. 275.	F., 16	Do.	Tuberculosis with suppuration.	—	Death on sixth day; cause not stated; nephrotomy previously performed.	D.	—
7	17. ii. '82.	Goodhart. *Med. Times and Gaz.*, 1882, i, p. 395.	M., 27	Do.	Tuberculosis of right kidney.	15 mos.	Diagnosis confirmed; kidney weighed 10 oz., and the patient died of collapse four hours after operation.	D.	—
8	ii. '82.	Golding-Bird. (Private.)	M., 27	Do.	Scrofulous kidney.	—	Diagnosis confirmed; cause of death, collapse; other kidney healthy.	D.	—
9	20. iv. '82.	Bardenheuer. (Private.)	M., 4	Do.	Tuberculosis with perinephritic abscess.	—	Diagnosis confirmed.	—	R.
10	5. vi. '82.	Bardenheuer. (Private.)	M., 11	Do.	Perinephritic abscess; tubercular left kidney.	—	Diagnosis confirmed.	—	R.
11	20. vi. '82.	Elder. *Lancet*, 1882, ii, p. 567.	F., 36	Do.	Tuberculosis with suppuration.	2½ years.	Nephrotomy performed on 10th Mar., 1882, fistula remaining; removed kidney tubercular.	—	R.

12	13. vii. '82.	Bardenheuer. (Private.)	M., 22	Lumbar.	Nephritis and perinephritic abscess; tubercular.	—	Diagnosis confirmed.	—	R.
13	11. xii. '82.	Vecchi. *Centb. f. Chir.*, 1883, No. 6, p. 95.	F., 33	Abdominal.	Pyelonephritis or malignant tumour.	3 years.	The kidney was tubercular, weighed 11 oz., and contained caseous masses and cavities.	—	R.
14	1882.	O'Reilly. *Brit. Med. Jour.*, 1883, i, p. 17.	F., 26	Lumbar.	Pyonephrosis of right kidney.	—	Death in 40 hours from collapse; no *post-mortem*.	D.	—
15	19. vi. '83.	Jowers. *Lancet*, 1884, i, p. 13.	F., 55	Abdominal.	Cystic tumour.	1 year.	Death in 46 hours, with fever and auria; the kidney tubercular, with cavities; no *post-mortem*.	D.	—
16	12. vii. '83.	Kidd. *Med. Times and Gaz.*, 1883, ii, p. 268.	F., 28	Do.	Pyonephrosis and cystitis.	2½ years.	Death in 24 hours from collapse; kidney contained tubercular abscesses.	D.	—
17	11. viii. '83.	Bennett-May. *Brit. Med. Jour.*, 1883, ii, p. 438.	F., 32	Lumbar.	Tuberculosis of right kidney.	4 years.	Death in four days; left organ represented by a mass of caseous material, and the other kidney was also tubercular; death from auria.	D.	—
18	viii. '83.	Gill-Wylie. *N. Y. Med. Rec.*, 1883, ii, p. 583.	F., 34	Abdominal.	Painful movable kidney (tubercular).	18 mos.	Tubercular bacilli in removed kidney.	—	R.
19	14. xi. '83.	Thornton. *Lancet*, 1883, ii, p. 921.	F.	Do.	Tuberculosis of right kidney.	7 years.	Diagnosis confirmed complete recovery in 10 days.	—	R.
20	21. vi. '84.	Bantock. *Brit. Med. Jour.*, 1884, i, p. 1261.	F., 33	Do.	Tumour of kidney.	—	Right kidney tubercular and dilated; ultimate result not published; five days after the operation the patient was doing well.	—	R.
21	11. xii. '84.	Wright. *Brit. Med. Jour.*, 1885, i, p. 432.	M., 17	Lumbar.	Renal calculus with tuberculosis.	—	Tuberculosis of both kidneys; numerous small calculi; left kidney removed quite disorganised; in right, abscess and calculi; death from exhaustion 8 days after nephrectomy.	D.	—
22	21. xii. '84.	Bardenheuer. (Private.)	M., 31	Do.	Nephrectomy and perinephritic abscess; tubercular right kidney.	—	Diagnosis confirmed.	—	R.
23	1884.	Tscherning. *Centb. f. Chir.*, 1884, No. 42.	F., 40	Do.	Tubercular pyonephritis.	—	Tubercular bacilli found in excised kidney.	—	R.

NEPHRECTOMIES FOR TUBERCULAR DISEASE OF THE KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
24	1884.	Ollier. *Rev. d. Chir.*, 1885, p. 848.	F.	Lumbar.	Tuberculosis with renal suppuration.	—	Tubercular kidney purulent; bacilli in removed kidney; death in 48 hours from septicæmia.	D.	—
25	3. i. '85.	Bardenheuer. (Private.)	M., ¼	Do.	Nephrectomy and perinephritic abscess; tubercular right kidney.	—	Death in 24 hours; cause not stated.	D.	—
26	24. ii. '85.	Bardenheuer. (Private.)	F., 37	Do.	Nephrectomy and perinephritic abscess; tubercular left kidney.	—	Diagnosis confirmed.	—	R.
27	23. v. '85.	Franzalini. *Gaz. Med. di Torino*, 1885.	F.	Abdominal.	Tuberculosis of right kidney.	—	Diagnosis confirmed.	—	R.
28	18. viii. '85.	Bardenheuer. (Private).	M., 23	Lumbar.	Do.	—	—	—	R.
29	13. x. '85.	Taylor. (Nottingham.) (Private.)	F., 21	Do.	Tubercular pyonephrosis.	2 years.	Diagnosis confirmed; cause of death, vomiting.	D.	—
30	1885.	Golding-Bird. (Private.)	M., 1¼	Do.	Strumous disease.	—	Strumous disease of kidney.	—	R.
31	14. xi. '85.	Verneuil. *Rev. d. Chir.*, 1886, p. 122.	F., 38	Do.	Renal tuberculosis.	—	Tubercular disease, extending to ureter, with pyonephrosis; diagnosis confirmed.	—	R.
32	23. xi. '85.	Lange. *Med. News*, 1886, p. 70.	F., 26	Do.	Right kidney tuberculous.	—	Tubercular cystic kidney; pain continued in right iliac region.	—	R.
33	27. viii. '86.	Clark. *Glas. Med. Jour.*, 1887, i, 321.	F., 24	Do.	Tubercular disease.	1 year.	Enlarged tubercular kidney with cavities; previous nephrotomy.	—	R.

NEPHROTOMIES AND NEPHRECTOMIES FOR TRAUMATIC LESIONS AND URINARY FISTULÆ, &c.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
1	xii. '70.	Gilmore. *Amer. Jour. Obst.*, v. 1871.	F., 33	Lumbar Nephrectomy.	Painful left kidney.	4 years.	The patient made a good recovery; left kidney atrophied.	—	R.
2	14. v. '72.	Durham. *Brit. Med. Jour.*, 1872, vol. i, p. 534.	F., 43	Do.	Renal calculus with hæmaturia.	—	Right kidney removed and found to be healthy, and no stone discovered; death from collapse.	D.	—
3	5. iii. '73.	Marvaud. *Rec. de Mém. de Méd.*, mil. 1874.	F., 15	Do.	Prolapse of the right kidney through a lumbar wound.	—	Recovery rapid; left the hospital 21 days after operation.	—	R.
4	7. vi. '73,	Brandt. *Wien. Med. Woch.*, 1873, No. 48-49.	M., 25	Do.	Prolapse of left kidney through lumbar wound.	—	Patient made a rapid recovery, and left the hospital 16 days after operation.	—	R.
5	20. x. '76.	Albert. *Revue Science Med.*, t. i, p. 972, 1883.	F., 35	Do.	Urinary fistula (lumbar).	—	Kidney normal: death from peritonitis.	D.	—
6	8. i. '79.	Zweifel. *Archiv. f. Gynæcol.*, xv. p. 1.	F., 29	Do.	Urinary fistula (uterine).	2½ years.	Kidney degenerated and atrophied; prolonged suppuration.	—	R.
7	2. viii. '69.	Simon. *Chir. d. Nieren Erlangen*, 1871, i, p. 29.	F., 46	Do.	Urinary fistula after ovario-hysterotomy (abdominal).	1½ years.	Kidney normal, recovery without complications; 7 years later, the patient died of phthisis pulmonalis, and at the *post-mortem* the right kidney was found much hypertrophied.	—	R.

NEPHROTOMIES AND NEPHRECTOMIES EOR TRAUMATIC LESIONS AND URINARY FISTULÆ, &c.—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
8	—	Cartwright. *Lancet*, i, 1880, p. 403.	M.	Lumbar nephrectomy.	Prolapse of kidney thro' lumbar wound.	—	Rapid recovery after operation.	—	R.
9	3. iv. '80.	Czerny. *Archiv. f. Klin. Chir.*, xxv, p. 862.	F., 27	Do.	Urinary fistula (vaginal).	5 mos.	Resection of twelfth rib. Kidney healthy; urine secreted in fair quantity after operation.	—	R.
10	iv. '80.	Stark. *Thesé Inaug. de Hans Bolz Dorpart*, 1883.	F., 17	Do.	Do.	—	Recovery without complications; kidney healthy.	—	R.
11	19. v. '80.	Credé. *Archiv. f. Gynæcol.*, xvii, p. 312.	F., 26	Do.	Urinary fistula (uterine).	4 mos.	Kidney normal; no complications.	—	R.
12	20. v. '80.	Le Fort. *Gaz. des Hôpitaux*, 1880, No. 138.	M., 23	Do.	Lumbar and urinary fistula.	8 mos.	Patient was much reduced previous to operation; died from shock in 24 hours; no peritonitis; other kidney normal.	D.	—
13	8. viii. '81.	Starck. *Berl. Klin. Woch.*, 1882, No. 12, p. 185.	F., 42	Lumbar.	Injury of right ureter during hysterectomy.	6 days.	Hydronephrosis and interstitial nephritis; the patient made a good recovery.	—	R.
14	7. xii. '82.	Rawdon (Liverpool). *Brit. Med. Jour.*, 1883, i, p. 1004.	M., 12	Do.	Rupture of kidney (right).	—	Diagnosis confirmed; death from suppurative pyelitis of left kidney.	D.	—
15	20. xii. '82.	Barker. (Private.) Also Heath's *Dict. of Surgery.*	M., 3½	Do.	Rupture of ureter leading to spurous hydronephrosis.	—	Both kidneys sound; death 15 months later from tubercular disease.	—	R.

16	14. i. '83.	Bardenheuer. (Private.)	F., 57	Lumbar.	Fistula right urinary.	—		—	R.
17	3. iii. '83.	Billroth. *Wien. Med. Woch.*, 1884, No. 23, p. 708.	F., 40	Do.	Abdominal fistula after ovariotomy.	7½ mos.	Death on 11th day from collapse; kidney enlarged and softened.	D.	—
18	28. vii. '83.	Thornton (J. K.) *Intern. Med. Cong.*, 1884, ii, 154.	F., 42	Do.	Wound of ureter.	—	Patient remains well.	—	R.
19	13. ix. '83.	Maunoury. *Cong. Franc. de Chir.*, 1885, p. 259.	M., 27	Lumbar nephrotomy.	Rupture of kidney.	—	Suppuration of the kidney, and a considerable portion of it disintegrated.	—	R.
20	1883.	Bœckel. *Cent. f. Chir.*, 1885, No. 12.	F., 41	Lumbar nephrectomy.	Vaginal urinary fistula after hysterectomy.	4 weeks.	Kidney enlarged from tubular nephritis and amyloid disease; Recovery from operation, but death 6 months after.	—	R.
21	4. x. '84.	Bardenheuer. *Die Drainirung der Perit-Höhle.* (Stuttgart), 1881, p. 246.	F., 48	Do.	Obstruction to left ureter.	—	Death in 24 hours from collapse; fatty infiltration of the heart and liver; no peritonitis.	D.	—
22	13. v. '84.	Thornton (J. K.) *Intern. Med. Cong. Rep.*, 1884, ii, 154.	F., 28	Abdominal nephrectomy.	Wound of ureter.	—	Immediate nephrectomy after wound of ureter.	—	R.
23	17. x. '84.	Bardenheuer. (Private.)	F., 25	Lumbar nephrotomy.	Nephritic colic.	—	Diagnosis confirmed.	—	R.
24	1884.	MacEwan. (Private.)	M., 21	Lumbar nephrectomy.	Ruptured kidney.	4 weeks.	Four weeks subsequent to accident patient became insensible, and almost *inarticulo mortis*; on admission blood passed in urine at intervals; death from shock 8 hours after operation.	D.	—
25	1884.	Iterson. *Centralb. f. Chir.*, No. 51, 1885.	—	Do.	Cystic kidney and lumbar fistula.	—	Persistence of small fistula.	—	R.

NEPHROTOMIES AND NEPHRECTOMIES FOR TRAUMATIC LESIONS AND URINARY FISTULÆ, &c.—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
26	—	Weir. *N. Y. Med. Jour.*, 1884, ii, 725.	F., 26	Lumbar nephrotomy.	Rupture of the kidney.	—	Perinephritic abscess; frequent puncture followed by antiseptic incision.	—	R.
27	31. iii. '85.	Péan. (Brodeur.) p. 231.	F., 46	Lumbar nephrectomy.	Contusion of right kidney.	—	Suppuration of kidney; perinephritic abscess; putrid discharge from fistula.	D.	—
28	3. vii. '85.	Monod. (Brodeur.) p. 276.	M., 30	Do.	Abdominal fistula.	—	Cystic kidney and interstitial nephritis; fistula persisted for some time.	—	R.
29	26. ix. '85.	Demons. *Bull. et Mem. Société Chir. Paris*, 1886, p. 450.	M., 49	Do.	Wound of the kidney and left lung.	—	Resection of a portion of lung which protruded as a hernia; perinephritic abscess.	—	R.
30	24. v. '86.	M'Laren (Carlisle). (Private.)	F., 24	Lumbar nephrotomy.	Nephralgia, with pus in urine.	2 years.	Nothing abnormal in kidney; general condition improved, but wound continued painful for some time.	—	R.
31	11. v. '86.	Trélat. (Brodeur.) p. 261.	F., 21	Lumbar nephrectomy.	Lumbar urinary fistula.	—	Kidney atrophied with calculi in the calices; rupture of pedicle without hæmorrhage.	—	R.
32	28. viii. '86.	G. N. Kreider. (Illinois.) (Private).	M., 34	Lumbar nephrotomy.	Impacted calculus in ureter.	2 years.	No calculus found "obstruction of ureter caused by a catarrh of that passage."	—	R.

LECTURE VI.

Tumours of the kidney. General remarks on classification. Renal neoplasms arranged according to their histological structure, and considered in the following order:—(a) *Benign—fibroma, osteoma, lipoma, hæmatangioma, adenoma, and papilloma,* (b) *Malignant—carcinoma, lymphadenoma, and sarcoma. Their pathology, morbid anatomy, symptomatology, physical signs, and diagnosis considered, and illustrated by specimens and cases. Treatment of renal neoplasms.*

Operations upon the kidney—(1) *For diagnostic purposes*—(a) *Compression and catheterisation of ureters,* (b) *Aspiration and tapping,* (c) *Exploratory incision.* (2) *For relief of disease,* (a) *Puncture,* (b) *Nephrotomy,* (c) *Nephrolithotomy,* (d) *Nephrectomy,* (e) *Nephrorraphy.*

GENTLEMEN,—When we were studying renal enlargements as a consequence of fluid accumulations, I was careful to distinguish between such morbid conditions as hydronephrosis, pyonephrosis or cystic degeneration of the kidney and tumours properly so called. Many writers, however, not only include these diseased states as varieties of tumours, but also place in the same category such lesions as arise from tuberculosis or from hydatids. To many clinicians the term tumour conveys very much the same idea as the word swelling, but it must be remembered that while all tumours are characterised by swelling, all swellings are not technically tumours. For example, hitherto I have only spoken of lesions associated with increase in bulk of the kidney such as might arise from collections of fluid, from inflammatory infiltrations, from the presence of parasites, or from a combination of these causes; none of these conditions can, however, be regarded as tumours any more than can a hydrocele or an accumulation of synovial fluid, although they may present the clinical fact of swelling. One, however, is inclined to regard any new formation as a tumour according as it fails to show the recognised clinical peculiarities of inflammation—pain, redness, and local elevation of temperature, together with a tendency either to spontaneous cure or to suppuration. Hence it is that gummata and strumous formations have retained their position amongst tumours longer than ordinary inflammatory new formations.

Within recent times three classifications of tumours have been proposed. The arrangement of tumours according to their clinical characters for a long time maintained its position, and was almost universally employed. But by reason of improved methods of microscopic investigation and an increase in our knowledge of histology, a purely clinical classification has become more and more impossible of application, and has now given way to one based upon minute structure. This anatomical classification has doubtless led to a more accurate knowledge of the structure and life history of tumours, and is more in accordance with scientific methods than any other previously proposed. But, while this must be admitted, it has also its disadvantages. That it is more accurate and acceptable than former classifications is shown by the circumstance that, while a few years ago it was little more than suggested, it is now almost universally adopted. In many cases undoubtedly it is easy, without any knowledge of the clinical facts, to diagnose the tumour from an examination of the structure alone. There are, however, a few equivocal cases, which, so far as we know, do not follow any recognised type either in their clinical history or in their histological appearance. It is in such instances that the surgical pathologist is beset with doubt.

Take for example the alveolar sarcoma and the endothelioma. The former is made up of cells closely resembling epithelium. These cells are dispersed in groups, separated from one another by a connective tissue stroma, and so present a structure closely resembling gland tissue. This tumour, however, differs from a true cancerous growth, in so far that the cells contained in the alveoli merge into, and are apparently developed from, the connective tissue stroma. In fact this growth seems to occupy a middle ground between the sarcomata and the carcinomata. It possesses an alveolar structure, and the cells resemble epithelium, but it differs from cancer in so far that the stroma and cells are intimately interwoven into a single tissue, whereas in carcinomata the cells and stroma are easily separated. These tumours are almost as malignant as the carcinomata, and, as a rule, cause secondary formations in the lymphatic glands. The endotheliomata are regarded by some histologists as identical with the alveolar sarcomata. They are, however, derived from the endothelium of the lymph spaces of lymphatic or blood vessels. They are composed of closely packed nests of proliferating endothelial cells surrounded by a well developed connective tissue stroma very similar to that of true cancer; indeed the principal point of distinction is their seat of origin. Because of this difficulty some pathologists maintain that the definitions employed by Virchow and followed by the pathologists of his school, cannot be adhered to, being founded solely on histological distinctions, and hence it has been proposed to classify growths according to the layer of the blastoderm from which the tissues, whence they are derived, have developed. In this classification the connective tissue groups of tumours, those developed out of tissue derived from the mesoblast are placed in one division, while the growths which contain in addition epithelial elements, structures developed from the epiblast and hypoblast are placed in another division; consequently, the endothelioma and alveolar-sarcoma are placed side by side, as endothelium is generally regarded as belonging to the connective tissues. I shall have occasion to revert to this point when we come to discuss the varieties of cancer and sarcoma of the kidney.

The histogenetic classification of tumours, although of great scientific interest, has not yet been sufficiently tested to meet with general acceptance. The histological arrangement seems to me a perfectly legitimate and more practical basis of distinction, although there may be some theoretical difficulties to contend with. Practically in the great majority of cases it is easy, simply from a microscopic examination, to prognosticate the course of events, and if to this knowledge be added information respecting the site of origin of the growth and a sketch of its life history, a reliable diagnosis can always be arrived at. A classification based on the minute structure is at present the only one available for practical men; it is the only one in which clinical observers and histologists can go hand in hand, the clinical character of the tumours justifying the anatomical distinctions.

CLASSIFICATION OF TUMOURS OF THE KIDNEY.

(A) *Benign.*
  1. Fibromata.
    (*a*) Minute growths (Nephritis interstitialis tuberosa).
    (*b*) Simple fibroma.
    (*c*) Fibro-cystoma.
    (*d*) Fibro-myoma.
    (*e*) Fibro-lipoma.
  2. Osteomata ?
  3. Lipomata.
  4. Hæmatangiomata.

5. Adenomata.
    - (*a*) Papillary.
    - (*b*) Alveolar.
6. Papillomata.

(B) *Malignant.*

7. Carcinomata.
    - (*a*) Encephaloid.
    - (*b*) Scirrhus.
    - (*c*) Colloid.
    - (*d*) Epithelioma.
    - (*e*) Cylindroma.
8. Lymphadenomata.
9. Sarcomata.
    - (*a*) Round-celled.
    - (*b*) Spindle-celled.
    - (*c*) Alveolar-sarcoma.
    - (*d*) Angio-sarcoma.
    - (*e*) Adeno-sarcoma.
    - (*f*) Myo-sarcoma.
    - (*g*) Myxo-sarcoma.

The first neoplasms of the kidney to which I desire to direct your attention are the pure fibromata and fibrocystic tumours. By most medical writers they are regarded as of no clinical importance. This view may be a correct one so long as the growth consists of small solitary nodules of connective tissue varying in size from that of a mustard seed to that of a pea—(the nephritis interstitialis tuberosa of Virchow)—but when the tumours assume more formidable proportions and demand operative interference they must be regarded as of interest to the surgeon.

In the *Transactions of the Pathological Society of London*, vol. xx, p. 224, Dr. Wilks narrates a case of fibrous tumour of the kidney. The patient, aged 53, was under the care of Mr. Todd. "About ten years before his death he consulted several medical men for hæmaturia and pain in the loins, and the opinion expressed by them was that he had a stone in the kidney. This went on for about four years, when a tumour was found on the right side of the abdomen. This gradually increased during the remaining six years of his life. It was tolerably evident that this was due to an enlargement of the right kidney; but whether from simple dilatation or from a new growth was not agreed upon. Under favourable circumstances for examination it was clear that the tumour was in part solid and in part fluid. A diagnosis of cancer was made by some, but objected to from the fact of the slow growth of the disease. The health did not suffer much, and finally the patient died with symptoms of a uræmic character."

The *post-mortem* examination revealed that the right kidney was converted into a tumour the size of a child's head, and the renal pelvis was enormously distended, which explained the cyst-like tumour felt during life. "The new growth was remarkably hard, and was translucent in appearance, so that the impression at first conveyed to the eye was that it consisted of fibro-cartilage; in fact, its resemblance to the fibro-cartilaginous tumours occasionally removed by the surgeon from the neck was very great. Its centre was breaking up, so that a ragged cavity existed in its middle. The microscopic examination showed that the tumour consisted of fibrous structure, there being no cartilage present in any part."

In the statistics of nephrectomies, five cases of fibroma of the kidney will be found, operated upon by Peaslee (2), Thomas (22), Bruntzel (29), Wahl (49), and Bardenheuer (26). To give you some idea of the enormous size to which some of these tumours may attain I may state the circumstances respecting two cases, one of fibro-cystic tumour operated upon by Thomas, the other a fibroma removed by Bruntzel. The patient of the former was a female, aged 21, who suffered from severe abdominal pain, caused by the presence of a tumour the size of the uterus at the eighth month of gestation. On the assumption that it was a multilocular ovarian cyst the tumour was tapped, and 6 ounces of fluid drawn off were found to be free from any of the constituents of urine. At the operation the tumour was found attached to the lower end of the kidney, and was ascertained to be a cystic fibroma growing from the capsule of the organ. The patient completely recovered from the operation, and was well in the course of four weeks.

The case recorded by Bruntzel is also a remarkable one. The patient was a female, aged 33 years, who for five years suffered from a painful elastic abdominal tumour which ultimately increased in size so as to occupy the greater part of the abdominal cavity. During its growth the patient suffered greatly from digestive disturbance.

Exploratory tapping gave negative results, and on physical examination of the pelvic organs the bladder and uterus were found to be free. At the operation the tumour was discovered to be a fibroma, which on removal weighed 37¼ lbs. The patient made a good recovery.

In some instances the fibroma is not simply formed of a single tissue, as in the cases just described, but contains two or more distinct histological elements. For example, in the table of operations you will find a case recorded by Billroth (Case 11) in which a tumour weighing nearly 40 lbs. was composed of muscular and fibrous tissue combined (fibro-myoma). The patient was a poorly developed female, aged 35, who suffered for three years from a non-fluctuant abdominal tumour, which increased rapidly in bulk, and caused considerable dyspnœa; but no alteration in the urine from the normal was detected, and the uterus and ovaries were healthy. The tumour was removed by operation, and all precautions were taken for her safety; but, notwithstanding, she died. Her death, in the absence of an autopsy, was believed to be from peritonitis.

In other cases the fibroma may become infiltrated with fat (Case 51) or may undergo cystic degeneration (Case 54).

The occurrence of true bony tumours has been doubted by most writers on the subject, many of the so-called bony growths being in reality calcified inflammatory products. The term ossification, as applied to the kidney, bears very much the same significance as when applied to the changes in the arterial wall in atheroma. I believe, however, that just as calcareous infiltration of cartilage may go on to ossification, as shown by Cohnheim, so also may calcareous infiltration of the middle coat of arteries, or the tunica propria of the kidney, undergo a similar transformation; but to call the resulting mass an osteoma is a misapplication of the term. M. Rayer, in his *Maladies des Reins*, describes a specimen in which both the capsule of the kidney and the mucous membrane of the renal pelvis were converted into hard shells resembling bone; but as a microscopic examination was not made of the tissue, doubts may be reasonably entertained as to its precise nature. But while I have been unable to find an undoubted example of the development of bone in the kidney, I would not be surprised should such a specimen present itself, judging from what occurs in other organs, such as the liver, in which particles of bone have been found.

Lipomata occur in the kidney as elsewhere, but they are extremely rare, and as far as I can ascertain have not, in a single instance, called for surgical interference. This is all the more remarkable, seeing that both in the pelvis and around the kidney fat is apt to increase in amount. Fatty degeneration of neoplasms, or inflammatory products, must, however, not be mistaken for true lipotama.

Rayer, Sturm, Browne, Klebs, and Ebstein have recorded cases. The latter observer narrates the following interesting case, which came under his notice in All Saints Hospital, Breslau:—

"The subject was an old woman who died of marasmus. The urine showed nothing striking, and was free from albumen. The right kidney was healthy, the left was enlarged to more than double its normal size. The large fatty capsule on the left side was in striking contrast to the absence of a capsule on the right. The fact most worthy of note was that the entire kidney consisted of fatty tissue without a trace of kidney tissue. The cortical portion, clearly defined, constituted a sort of cloak to the pyramids, which were sharply separated from each other. The capsule coadhered inseparably to the yellow mass of fat. The blood contained in the organ was quite scanty. The pelvis and ureter were healthy."

Sir Spencer Wells successfully removed two solid circum-renal tumours (51), one of which weighed 16½ lbs. and the other 14½ lbs. The case was published in the *British Medical Journal*, vol. i, 1884, p. 758, and the following is the description of the preparations given by Mr. Eve, who describes the tumours as fibro-lipomata:—

"The portion of kidney torn away comprises more than one-third of the lower end of the organ. A calyx and papilla may be seen upon the torn surface; they afford conclusive evidence that the pelvis was opened. Within the calyx is a small mass of fat. A section of the kidney has a normal appearance. Surrounding the surface of the kidney is a tolerably firm, greasy, pale yellowish white substance, evidently consisting in great part of adipose and fibrous tissues. It is in close contact with the capsule of the kidney, but is only adherent to it over a surface about half an inch in length. The capsule can be easily separated from the kidney at this point, leaving the subjacent parenchyma perfectly smooth.

"The portion of the tumour from the opposite side was slightly more fibrous in texture, but otherwise similar in its naked-eye characters.

"In minute structure, both tumours consisted chiefly of adipose tissue. The fat-cells were large and closely approximated. There were also many large tracts and bands of fibrillar connective tissue, consisting of a close interlacement of delicate fibrils, which gave it somewhat the appearance of mucous connective tissue, but stellate cells were absent. The blood-vessels were large and numerous, and around them were masses of small round, so-called 'indifferent' cells, which could be traced through transitions, by elongation, to the formation of fibres.

"The formation of fat was evidently secondary to the growth of fibrous tissue, the advance of the fat-cells into it being apparent; while the various stages in the transformation of the fixed connective tissue-corpuscles into fat-cells were distinctly seen. Sections, cut through the point where the tumour was adherent to the kidney, showed that numerous parallel fasciculi of fibrous tissue intervened between the kidney-substance (which was healthy) and the tumour.

"The anatomical relations of the tumours to the kidneys, and the microscopic examination, support the view that the tumours originated neither in the pelvis nor capsule of the kidney, but in the circumrenal connective tissue.

"Histologically they were fibro-lipomata, and no grounds exist for believing them to be in any part sarcomatous, since the young cell-element exhibited a distinct tendency to form mature tissues, either fibrous or fatty. A complete immunity from further disease may, therefore, be anticipated, provided that the growths were completely removed."

A condition somewhat resembling, but not likely to be mistaken for lipoma of the kidney, is illustrated by the specimen I now show you. It is one which I placed in the Royal Infirmary Museum a few years ago, and is a very good example of fatty transformation of the kidney. In this case, as you will observe, the kidney is greatly reduced in size, and is completely embedded in a mass of firm fat. In this case the fat appears to have developed from outside the kidney, and, pushing its way into the interior of the organ by the hilus, caused atrophy of the renal tissue.

Similar cases have been observed by Rayer, Godard, Browne, Whipham, Heath, and Rickards. They show that fatty transformation of the kidney is frequently associated with a unilateral suppurative disease, which leads to an atrophy of the renal parenchyma, and a substitution of it by fat, while at the same time the organ on the opposite side undergoes a compensatory hypertrophy, and therefore the condition of the diseased kidney may not be suspected during life.

Tumours, principally made up of blood-vessels are very uncommon in the kidney—so rare, indeed, that I have been unable to discover a single instance in which a hæmatangioma cavernosum called for operative interference. These growths are stated by Virchow to be most common immediately underneath the renal capsule, but they may also form in the zone of limitation. They seldom attain a size larger than that of a bean, and are found to co-exist with and present a structure similar to telangiectasis of the liver. From the surgical standpoint they are unimportant.

Adenomata of the kidney present a structure resembling ovarian adenoma, and may be divided into two varieties, the papillary and the alveolar, which tend to merge into one another. The former has its origin in the medulla, and, on microscopic examination, will be found to consist of tubules and acini, into which papillæ project, lined with cylindrical epithelium. The alveolar variety forms most commonly in the cortical area, and is formed of dilated tubules lined by epithelium similar to that of the convoluted tubules. These growths are regarded as extremely rare, but this is due probably to the small size to which they attain and their general inoffensive character. When microscopic in size they are not unfrequently seen as small pale fibrous nodules, which on more minute inspection will be found to justify their being placed amongst the adenomata. Not uncommonly these neoplasms attain the size of a pea or a horse bean, but it is very rare indeed for them to develop to such dimensions as to demand operative interference. I have, however, found three examples of this disease which demanded operation, namely, the cases of Czerny (16), Schönborn (64), and Weir (72).

A case, which, as far as I can ascertain, is a unique one of papilloma of the kidney is published by Billroth in the *Wiener Med. Wochenschrift,* 1884, No. 25, p. 774. The patient was a man aged 33, whose antecedent history was unknown, further than that he suffered for a long time from a swelling in the region of the left kidney, which was diagnosed to be a tumour by Biermer, of Breslau. By lumbar nephrectomy Billroth (Case 45) removed the tumour (three times the size of the closed hand), which proved on microscopic examination to be an interstitial papilloma.

The varieties of renal tumour which still remain for our consideration are the carcinomata, the sarcomata, and the lymphadenomata, all of which are highly malignant, and have therefore been too generally described both in books and in museum catalogues under the common term of "cancer." It will be seen, however, by consulting the table of nephrectomies for renal tumours that out of the 74 cases recorded, 36 are set down as sarcomata, while 25 are denominated cancers, and probably if these latter were strictly inquired into, several of them, notably cases Nos. 6, 18, 34, and 50, would be found to be sarcomata.

The following table compiled by Labadie-Lagrave is intended to demonstrate by statistics the different ages at which cancer of the kidney shows itself; and to his figures I have added the cases of renal cancer collected in my own statistics, where I have named the growths as I have found them in the published records.

By these figures it is made to appear that cancer of the kidney, unlike carcinomatous disease of other parts, does not limit itself to the declining years of life, but is even more frequently observed during childhood. If the statistics quoted be taken collectively, it will be seen that 48 per cent of the cases were under 10 years of age. The succeeding 30 years claim only 19 per cent, while the remaining 33 per cent occurred in individuals between the ages of 40 and 70.

Age.	Roberts.	Rohrer.	Rosenstein.	Newman.
Under 1 year, .	1	6	1	—
From 1- 2 years, .	4	10	—	—
,, 2- 3 ,, .	6	4	—	2
,, 3- 4 ,, .	5	6	—	—
,, 4- 5 ,, .	—	5	—	—
,, 5- 6 ,, .	—	1	—	2
,, 6- 7 ,, .	—	2	11	—
,, 7- 8 ,, .	2	1	—	—
,, 8- 9 ,, .	—	2	—	—
,, 9-10 ,, .	1	—	—	—
,, 10-20 ,, .	1	—	—	—
,, 20-30 ,, .	6	—	5	4
,, 30-40 ,, .	4	—	3	5
,, 40-50 ,, .	3	—	3	1
,, 50-60 ,, .	7	—	16	6
,, 60-70 ,, .	7	—	—	2
,, 70 upwards, .	1	—	2	—
	48	37	41	22

The circumstance that statistics show the disease to be limited to the two extremes of life suggests grave doubts as to the accuracy of the diagnosis between the different varieties of malignant disease. Clinically it is only occasionally possible to form a reliable opinion of the nature of the growth during life, but surely now, if not formerly, it is easy, by careful microscopic examination, to distinguish one variety of malignant disease from another. It is only by a careful study of these growths on the lines laid down by modern pathology that a satisfactory foundation of facts can be accumulated upon which the surgeon can base his diagnosis.

Primary cancer of the kidney was considered at one time to be an extremely rare disease, so that its very existence was doubted by many. Hence it attracted very little attention from the physician and none at all from the surgeon. In 1810, Miriel for the first time called attention to this disease, and Wilson, in his book on *Diseases of the Kidney*, published in 1817, also discoursed upon it. Following upon the writings of these authors are the contributions of Langstaff, Darwell, Decramier, Bennett, Cruveilhier, Dance, Lever, Kœnig, and others.

Dr. Walshe, in his admirable work on *The Nature and Treatment of Cancer*, published in 1846, gives an epitome of what was then known, which is still well worthy of perusal. He, however, did not then sufficiently distinguish between primary and secondary disease. This is to be regretted, but not wondered at, seeing that until a few years previous to the time he wrote scarcely any attention was paid to cancerous disease of the kidneys, and, consequently, as he observes, it is "difficult at the present day to form even an approximate estimate of its absolute or relative frequency. But that implication of this organ is far from being a very rare phenomenon of the cancerous diathesis is matter of established notoriety, while its occurrence as a primary disease is less common than is generally fancied."

In the article just referred to the cases published in the classical work of Rayer a few years previously are fully discussed.

Lebert in 1841 discusses fully the pathological anatomy of renal cancer, and carefully distinguishes between the primary and secondary forms of the disease. From this time many valuable and interesting articles and cases have been published, amongst which I may simply mention those of Robin, Cornil, Neumann, Lancereaux, Waldeyer, and Pereverseff.

Cancer of the kidney may be described under five varieties—namely, encephaloid, scirrhous, colloid, epithelioma, and cylindroma, and may be observed either as a primary or as a secondary neoplasm.

Primary carcinomatous disease is generally confined to one kidney, but may include both organs. Of 59 cases collected by Ebstein, 31 involved the right, 23 the left, and 5 both kidneys. As a secondary disease, however, as might be expected, both organs are usually attacked.

Encephaloid cancer is the form most frequently met with, and may attain an enormous size. Sir Spencer Wells reported the case of a child, aged four years, who had a tumour weighing between sixteen and seventeen pounds; Van der Byl also observed one weighing 31 pounds, and cases have been operated upon by Walcot (1), Barker (14), Lücke (19), Wells (32), Homans (43), and Albert (56), where the growth exceeded 30 ounces in weight, and in one instance Réczey (28) extirpated a carcinomatous kidney weighing eight pounds.

In some cases the carcinomatous elements are uniformly disseminated throughout one organ, so that while the kidney becomes increased in bulk and round in appearance it retains to some extent its renal form, and on section it may even be possible to distinguish the medulla from the cortex. In this, the diffuse form of the disease, the neoplasm may penetrate to and extend along the renal pelvis, so that portions of its tissue escape in the urine.

In the other variety, of which the specimen I now show you is a typical example, the disease appears as if it developed from several independent foci, which have increased in bulk and formed nodules and prominences of various sizes.

This specimen was removed from the body of a man who died in the Royal Infirmary, under the care of Dr. Robertson, and was shown by that gentleman and Dr. Dalziel at the Glasgow Pathological and Clinical Society, April, 1886. The right kidney, when removed from the body, weighed 12 ounces. At the upper part of the organ you will observe a tumour about the size of a cricket ball. The greater part of the growth was of a bright pink colour, and tolerably firm in consistence; but here and there were points where softening and hæmorrhage had occurred. On section the tumour was found to be clearly limited from the surrounding renal tissue, being distinctly encapsuled, so that the tissue lying between the nodules appears practically normal. Besides several nodules about the size of a pigeon's egg, there are a number of small isolated and clearly circumscribed nodules, apparently of recent growth —probably secondary formations. The following report of the *post-mortem* appearances was made by Dr. Dalziel, who was acting for me at the time:—

Sectio—performed 24 hours after death. The body was somewhat emaciated, with marked œdema of feet and ankles. In the subcutaneous tissue, especially over the thorax, were several hard, freely movable nodules, about the size of a pea. On opening the thorax, the pleura and pericardium appeared œdematous, and were studded with numerous firm pale nodules, varying in size from a millet seed to a split pea. These nodules could be readily separated from the tissues in which they were embedded. The right pleural cavity contained about 5½ ounces of turbid fluid slightly tinged with blood. The surface of the lung was studded, and, indeed, almost covered by slightly elevated white firm growths, the largest of which, situated on the posterior aspect of the lung, covered an area equal in size to a threepenny piece, and from the surface of these larger nodules passed recent somewhat lengthy adhesions to the parietal pleura, which was markedly congested, the surface being rough, and of a deep reddish-brown colour, and exhibiting several nodules similar to those in the visceral pleura. The appearances presented by the left pleural cavity were similar to those in the right; it contained 7 ounces of fluid. In the pericardium was about 1 ounce of slightly milky fluid. The surface of the heart presented about 20 hard, firm, white growths similar to those found elsewhere; the larger of these nodules were elevated quite ¼ inch from the level of the surface. A few smaller nodules studded the parietal pericardium, which was somewhat congested. The muscular substance of the heart was also infiltrated with similar nodules, apparently carcinomatous, some of them being the size of a hazel nut. The organ weighed 10 ounces. Section of the lungs showed them to be infiltrated with similar neoplasms, especially distributed along the course of the bronchi and bronchioles, though there not nearly so numerous as on the surface of the organ. Otherwise, the lung tissue was œdematous, and the bronchial mucous membrane was congested and coated in parts with fibrinous lymph. The bronchial glands were much increased in size, varying from a walnut to a hen's egg; were hard, and of a pale yellow colour, and shelled out readily from the surrounding tissue.

Abdomen.—The peritoneal cavity contained about 10 ounces of slightly turbid fluid. The great omentum, parietal, and visceral peritoneum generally presented numerous scattered nodules, the majority of which were of small size, and of character similar to those found in the pleura. There was no congestion or dimming of the peritoneal surface. The liver weighed 84 ounces, and was healthy, apart from a very few minute growths scattered widely through the substance of the organ. The spleen was not affected. Its tissue was firm and the organ weighed 5¼ ounces. Apart from the condition of the peritoneum, the stomach and small intestine presented nothing abnormal, unless an unusual thinness of the wall of the latter. The wall of the great intestine was markedly thickened; its mucous membrane rough and irregular; of a greyish colour, mottled with red and brown patches, with several recent hæmorrhagic spots. This condition was uniform throughout, and had been caused by chronic enteritis. Microscopic examination showed the follicles represented by short pits on the surface of a much thickened sub-mucosa.

On the mucous membrane of the bladder was a solitary nodule about the size of a pin's head. The right kidney weighed 12 ounces, and in its upper half was a tumour about the size of a cricket ball, of a varying consistence, some parts of it being extremely hard, while in other places it seemed as if almost fluid.

Section of the tumour proved it to be encapsuled more or less completely, and to consist of several nodules about the size of a pigeon's egg, with a somewhat soft medium. This tumour presented numerous patches of hæmorrhagic degeneration. In the kidney substance were numerous small recently formed growths similar to those found in the other organs. Otherwise the kidney tissue appeared healthy. The left kidney weighed 8 ounces. Capsule stripped off readily, and the organ was in a condition similar to the right, with the exception of the large tumour described. The suprarenal capsules were much enlarged and extremely hard, with a markedly nodular surface of a pale yellow tint.

The lymphatic glands lying about the coeliac axis were also much enlarged and very hard. Pancreas normal.

Since this specimen was shown at the Society, I have made a careful microscopic examination of a large number of sections for the purpose of determining the mode of origin of the tumour, with special reference to the relationship of the carcinomatous elements to those of the normal kidney tissue. The circumstance that cancer of the kidney may involve limited portions of the organ, while other parts are free from disease and their appearance only altered as a direct result of pressure, suggests the idea that the process of change has been one of transformation or alteration in the elements of the renal tissue, rather than of addition of new material. First, in respect to the fibrous stroma. In some parts the fibrous matrix was very abundant, while in others the groups of epithelial cells were separated from one another only by the most delicate network of elongated cells and fibres; but whether large or small in amount, the fibrous tissue of the tumour was found to be continuous with, and evidently developed from, the inter-tubular connective tissue of the kidney.

To the naked eye the nodules seemed to be limited by a clearly defined margin, which presented the appearance as if the growths were encapsuled; but when examined microscopically this limitation was found not to be so sharp. In the immediate neighbourhood of the advancing cancer the epithelium of the uriniferous tubules was seen not only to be undergoing a process of proliferation, but the individual cells varied greatly in size and form, so as no longer to present the characteristic appearance of renal epithelium. At the points where proliferation was most abundant these altered epithelial cells formed little groups contained within small cavities, the walls of which were composed of a delicate network of fibres. Further away from the cancerous foci the epithelium of the uriniferous tubules was less altered from the normal type. This was not only true of the tubules collectively, but in one or two individual instances in which a tubule was so cut as to be seen throughout a considerable extent, the progressive changes could be observed, and made it abundantly evident that the epithelium of the cancer was derived directly by a process of proliferation from the normal renal epithelium.

My own observations are quite in accordance with those of Pereverseff, who many years ago demonstrated (Virchow's *Archiv*, Bd. lix) that in renal cancer the epithelium of the neoplasm remains in many instances enclosed within the basement membrane of the uriniferous tubules, and showed that the gradual process of transition from the normal to the abnormal can be traced within an individual tubule. Contrary to this view, Waldeyer holds that the endothelium of the blood-vessels and lymphatics contributes by proliferation to the new growth.

In the specimen which I have just described the amount of connective tissue throughout the bulk of the growth was considerable. In other cases the tumour, being very rich in cellular elements and blood-vessels, is soft, and the stroma is only represented by a very fine and delicate reticulum, derived probably from the greatly thinned walls of the blood-vessels. Sometimes, indeed, the stroma is so fine that even in stained sections the epithelial cells require to be brushed away before the connective tissue elements of the tumour can be clearly discerned. On the other hand, the fibrous stroma may predominate, causing atrophy and degeneration of the epithelial cells. In this, the scirrhous variety of cancer, the amount of stroma varies greatly in different parts of the tumour; while at some parts it is very abundant and formed of well developed fibrous tissue, at other portions of the growth it is less abundant and more cellular. Scirrhus occurs rather as an infiltration than as a distinct tumour, and, as shown by Walshe, Wilson, Cruveilhier, Rayer, and Lebert, may involve the entire kidney.

The distinction between encephaloid and scirrhous cancer is not very clearly defined, as there are cases which present all shades of gradation, and it may be stated as a general rule that the less cellular the growth is, and therefore the more it approaches the scirrhous type, the less malignant is it likely to be.

Renal epithelioma is very rare. Robin recorded a case of this kind in which the left kidney was involved and greatly increased in bulk. The diseased organ was adherent to the spine, and for the most part formed a hard, firm mass. At some parts, however, the neoplasm had degenerated and softened so as to present a creamy pultaceous appearance. The growth was not limited to the renal substance, but also occupied the pelvis. Doubts have been repeatedly expressed by various writers respecting the precise nature of the tumour, some regarding it not as an epithelioma, but rather as an example of encephaloid disease.

In *St. Bartholomew's Hospital Reports*, vol. xxi, Dr. Walsham reports a very interesting case in which he performed nephrolithotomy for calculous pyelitis, and after the death of the patient, two days subsequent to the operation, not only was the left kidney found to be converted into an abscess cavity, but "the upper half of the kidney presented the appearance of a new growth, which under the microscope proved to be an epithelioma. The ureter could not be traced to the kidney." The epithelioma, as suggested by Dr. Walsham, was probably the result of the irritation of the impacted calculus. This co-existence of renal calculus and cancerous disease was recognised by Dr. Bright, who relates one instance in which the pelvis contained an oxalic acid calculus, and a lactic acid one in another case.

Brodeur (page 170) also gives a very full account of a case of epithelioma of the right kidney operated upon by Terrier (case 68, p. 457). The patient was a female aged 36, who, in October, 1885, developed a tumour in the right loin, which rapidly increased for 5 or 6 months, and then remained stationary for 2 months. The right kidney was removed by abdominal nephrectomy, and the patient died the following day from collapse. At the *post-mortem* examination the left kidney was found to be enlarged and diminished in consistence from the normal, and contained numerous small cancerous nodules. The inferior extremity of the nephrectomised kidney was the size of the fist, and on its surface were numerous cancerous nodules. The whole organ weighed about one pound. The bulk of the inferior part of the kidney presented a greenish colour, and was slightly softened towards its centre. The pelvis and calices contained calculi. The part of the kidney away from the growth appeared to be healthy, and showed the normal markings of the organ. A portion of the tumour was examined microscopically by M. Brault in Professor Cornil's laboratory, and the following is a translation of his report:—

"In the principal tumour it is difficult to say what has been the starting-point of the neoplasm. Here and there the structure of the organ is recognised—tubes lined with a fatty-granular epithelium, arranged in one or two layers, representing what remains of the original tissue. Everywhere else is seen a great quantity of epithelial cells massed together, of clear protoplasm, with rounded ends, and clearly of a cylindrical type. These are transformed gradually into fatty-granular cells. In many places the connective tissue of the tumour is well developed. From this first examination one thing only can be concluded—namely, that the growth is a cylindrical-celled epithelioma; but the different parts of the tumour are too much altered to allow of the evolution of the cellular alterations being followed.

"In a little nodule lately developed, and situated immediately under the capsule of the kidney, the series of modifications through which the renal cells pass can easily be followed.

"Here the general form of the gland is preserved, but the tubules instead of being lined by a single layer of dark-coloured and granular epithelium, show a covering of clear cylindrical cells disposed in several layers. The tubules of the kidney are still recognisable, and especially so in the periphery of the small tumour.

"Step by step the metamorphoses of the epithelium can be followed as it is transformed into clear cylindrical epithelium. The most distended tubules show a wall with its contour not exactly circular, but oval or elliptical, and even in many places the tubules are broken, their cavities communicating one with another. The wall of the tubes is then shown by a line broken in the formation of re-entrant angles. New epithelial formations have at first the clear cylindrical type with rounded ends. In the most extensive tubules are often found in the centre of the cavity, irregular cylindrical or cubical cells filled with fatty matter, and derived from normal cells by a series of retrograde modifications. It means, then, in this case that the cylindrical-celled epithelioma originated without doubt in the epithelial lining of the renal tubules."

A case of epithelioma of the kidney is also reported by Péan, and quoted in detail by Brodeur (*De L'Intervention Chirurgicale dans les Affections du Rein*, page 156), and referred to in my table of operations (case 47, page 455). In Brodeur's account of the case a careful description is given of the histological appearances, and the diagnosis of epithelioma is confirmed by M. Ch. Robin.

Colloid cancer is a well recognised though somewhat rare variety of renal tumour. I am fortunate, however, in being able to show you a specimen of this disease. The patient, a woman aged 45, was under the care of Dr. Robert Perry in 1870, in the Glasgow Royal Infirmary, to which she was admitted six weeks before her death. At the *post-mortem* examination the preparation you now see was removed; the kidney was found to be connected with, and partly occupied by a tumour larger in size than an orange. The tumour was seen to project from the convex margin of the right kidney, and on section was found to be composed of a soft almost disintegrated tissue, which towards the hilus merged into the normal renal tissue. From a microscopic examination of a portion of the tumour, I was satisfied that the disease was an example of cancer which had undergone a moderate amount of colloid degeneration. In the bulk of the tumour there is nothing visible to distinguish it from an ordinary case of soft cancer, but in some parts the colloid degeneration of the epithelial cells, and the form of the stroma are characteristic.

An interesting case of colloid cancer of the kidney is reported by Dickinson, in which a kidney containing some large calculi had become dilated into an enormous multilocular cyst, supposed during life to be ovarian. This cyst was filled with gelatinous material not distinguishable from colloid cancer; during life portions of the contents escaped into the bladder, and after death calculi, composed of phosphate of lime, were found in the renal pelvis. Rokitansky nad Gluge have also reported cases, and Schueppel (Eberhard, 1869) observed a colloid renal cancer weighing 26½ pounds.

In a few instances cylindromata have been met with in the kidney. These tumours occupy a peculiar position, being by some observers included under the sarcomata, while others prefer to place them amongst the carcinomata. In order to distinguish between tumours produced by sarcomatous tissue undergoing hyaline or mucoid degeneration, and those in which epithelial cells are involved, the term cylindroma carcinomatoides has been applied to the class of growths we are now about to consider very briefly. Wagner has described two examples of this disease, and a few doubtful cases have been mentioned by other authors. As a matter of fact great diversity of opinion exists regarding the precise nature of this tumour, wherever it may be met with. For example, Meckel called it a tubular cartilaginous tumour, Friedreich a tubular sarcoma, Henle a siphonoma, and Billroth a cylindroma. From its rarity as a renal tumour it is of interest, and on account of its close relationship to the alveolar sarcomata (a class of neoplasms to which I shall ask your attention farther on), it is worthy of a passing notice.

I may now ask your attention for a few minutes to the secondary formations following upon primary cancer of the kidney. A point of considerable importance is the tendency of renal cancers to burst into, or involve the veins. Velpeau and Moritz (*De Pathologia et Diag. Aneurys. Inter.*, 1835) recognised this fact, and also the circumstance that coagula may form around the secondary cancerous mass, and extend into the vena cava inferior or even to the right auricle; in one case Gintrac observed the vena azygos obstructed by a carcinomatous formation. In the *Glasgow Medical Journal*, February, 1871, Professor Gairdner and Dr. Joseph Coats recorded a very interesting case of soft cancer of the right kidney in which cancerous coagula formed in the heart and pulmonary arteries. This case is so interesting and important that I think it right to read to you an abstract from the *post-mortem* record of it.

"*Chest.*—A small quantity of fluid in pericardium. The heart weighs 14½ ounces, and is very soft. On cutting into the inferior vena cava, with a view to removal of heart, a quantity of pale soft clots escapes. Similar clots are found filling the entire right heart; they present an opaque white colour and granular appearance, and, on pressure, break down into *débris* resembling dirty pus.

"Left lung is completely crepitant throughout; posteriorly slightly hyperæmic. The left pulmonary artery is found to present in almost all its branches firm masses, which are perfectly pale, and firmly adherent to the internal coat. They can be traced into most of the branches, even the smallest that are discoverable by the naked eye. The right pulmonary artery and its branches are generally free, but in one a similar obstruction is found. The right lung is somewhat œdematous. At inferior border of lower lobe, and about the middle of that border, a white solid deposit of the size of a hazel nut is found; on pleural surface it presents a smooth appearance and an opaque yellow colour. In both pleural cavities there is a small quantity of serum.

"*Abdomen.*—Spleen slightly enlarged, weighs 8¼ ounces.

Stomach nearly empty; mucous membranes presents mottling, in some parts of a livid red, and in others of a nearly black colour. Liver large, weighing 4 lbs. 14½ ozs. On section presents merely slight fatty infiltration.

"Left kidney is slightly anæmic and rather large—structure normal.

"Right kidney presents a well marked pathological formation, having the characters to the naked eye of very soft cancer. This kidney is slightly, but not remarkably enlarged; the capsule is readily separated, and about the lower half of the surface presents the normal smooth appearance. The upper half is generally much paler in colour, with a certain amount of red mottling. The surface also presents considerable irregularity, in the form of smooth rounded bulgings. One of these, at the extreme upper part of the kidney, is very prominent, and extremely soft, so that it feels almost like a cyst with semifluid contents. On making the usual longitudinal section of the kidney, the upper two-thirds is found to present, in the more central portions, very marked softening, almost amounting to diffluence. The softening, which is generally central, extends to near the surface at the most superior part, just where the projection from the surface, already mentioned, exists; but elsewhere there is a comparatively thick wall of renal tissue between the softened part and the surface. This renal tissue presents the usual distinction of cortical and pyramidal substance, but this distinction is considerably less marked than in the normal kidney; the tissue in the affected part is also markedly paler.

"On tracing up the renal vein from the vena cava inferior, it is found to be completely filled and considerably distended with pale soft material, exactly similar, in naked-eye characters, to the softened masses in the kidney. On cutting up the vein with the scissors, its cavity is seen to be directly continuous with the softened portions of kidney, this communication extending even to the more isolated mass situated in superior part of kidney.

"*Head.*—The longitudinal sinus contains some semifluid blood. The vessels at base present nothing remarkable. Left lateral ventricle slightly distended with pink serum. Brain substance rather soft, otherwise nothing remarkable.

"*The left inferior extremity.*—The internal saphena vein is found enlarged and filled with dark firm clot; and about the level of the knee, there is attached to it a firm tumour of the size of a large walnut. The tumour presents a smooth external wall, and lay in a clean bed in the adipose tissue, immediately beneath the skin. On cutting into it, it is found to consist chiefly of coagulated blood, with a thin external capsule. The capsule is continuous with the wall of the vein, and the clots with the contents of this vessel, so that the tumour forms a well defined varicose dilatation of the vein. The vein beyond the tumour also contains clots, and, on tracing it upwards to the vena cava, it is also found filled with coagula. The coagula are, up to the level of Poupart's ligament, generally dark, with pale streaks; just beneath Poupart's ligament they are paler and more contracted; above it, again, they are generally of a brownish colour, merging into a very pale brown, just beneath the union of the two common iliacs. In the upper part of the inferior vena cava are found clots similar in character to those in the right side of heart. To a smaller extent, clots similar to those in the veins of the left leg, are found in the veins of the right leg. In all these vessels the coagula are firmly adherent to the walls of the vessels, so that the internal coat generally comes away on tearing out the clots."

The lymphatic vessels also frequently serve as channels of infection, so that probably the most common locality in which secondary deposits are found is the lymphatic glands in the immediate neighbourhood of the affected kidney, and these are sometimes more widely involved than the organ primarily attacked. On the other hand the infection may be by continuity. The growth may extend through the capsule to the surrounding parts, involving the abdominal organs and the surface of the peritoneum; and it may infect the pleura either by penetrating the diaphragm, or by spreading along the retro-peritoneal tissue behind the posterior attachments of that muscle.

As a rule, however, renal cancer remains strictly localised for a considerable time, consequently if an early diagnosis can be arrived at, some hopes may be entertained of eradicating the disease. Another circumstance worthy of note, and one of special interest in view of the opinion that cancer is inoculable, is that cancer of the kidney is very rarely followed by carcinomatous disease of the lower urinary tract.

Lymphadenoma, as it attacks the kidney, is not an uncommon disease, but it is one which does not call for the aid of the surgeon, for it occurs in the kidney only as a part of a general disease in which similar lesions are found in other organs. The development of the tumours in the kidney is by metastasis, the primary growth having originated in the lymphatic system. To give you an idea of the appearance of the kidney in this disease I cannot do better than quote the following description of a case which was brought before the Pathological Society of London by Dr. Murchison (*Trans. Path. Soc. Lond.*, xx, p. 192).

The case was one in which the morbid growth occurred in a man aged 24. The illness for which he sought relief commenced eight weeks before admission to the Middlesex Hospital, with great pain across the abdomen, and vomiting especially after taking food. A tumour in the abdomen was noticed a month previous to admission, and soon afterwards the swelling spread to the legs. These symptoms were accompanied by great loss of flesh, night sweats, dyspnœa, and slight cough, but no hæmoptysis or diarrhœa. Urine pale and clear, no albumen. The patient died two days after admission—that is to say, a little more than eight weeks from the onset of the disease—and at the *post-mortem* examination the growth was found to have involved the intestine, liver, kidneys, lymphatic glands, heart, and other organs. The kidneys were "congested and contained numerous opaque white deposits raised above the outer surface, and also imbedded in the cortical tissue and pyramids. They were for the most part rounded, and some were as large as a small cherry. To the naked eye these deposits would at once have been taken for cancer, but the microscope showed that they were entirely made up of a nuclear tissue deposited in the interstices of the tubules and permeated by the renal vessels, which imparted to them an appearance of vascularity. A small quantity of urine obtained from the bladder contained no albumen." Microscopic examination showed that "those parts of the cortex, on the other hand, which appear to the naked eye healthy, are found to be really so when examined under the microscope. In sections obtained from the margins of the nodules, and made in a direction parallel to the surface, it is seen that, although in many parts neither the epithelium of the convoluted tubes nor their capillaries have undergone any appreciable change, the connective tissue web is beset with corpuscles of the same character and appearance as those which form the new growth in other parts."

Lymphadenomata are of pathological interest on account of the difficulty of distinguishing between them and round-celled sarcomata, from which they can be separated by the circumstances that they originate in lymphatic tissue, that their limits are ill-defined, and that on microscopic examination a characteristic reticulated stroma may be found by carefully inspecting sections which have been pencilled out with needles. But while lymphadenomata originate in lymphatic tissue, they may develop as secondary formations in parts such as bone, liver, ovaries, and kidneys, which normally do not contain any lymphadenoid tissue. These distinctions between the lymphadenomata and the sarcomata are not accepted by all pathologists, some of whom place the heteroplastic tumours, whose structure corresponds with that of lymphadenoid tissue, amongst the lympho-sarcomata.

Without following this histological question further, I will now proceed to bring under your notice the main facts connected with the sarcomata. These growths may be classified according to their histological characters. The following varieties have been found in the kidney:—

Sarcomata.

(*a*) Round-celled.
(*b*) Spindle-celled.
(*c*) Alveolar-sarcoma.
(*d*) Angio-sarcoma.
(*e*) Adeno-sarcoma.
(*f*) Myo-sarcoma.
(*g*) Myxo-sarcoma.

The sarcomata may be conveniently considered under two divisions, according as they are primary or secondary.

Primary growths are considered to be of rare occurrence, and are believed to be generally congenital in their origin. When the disease is primary, it usually affects only one kidney, and causes death by a process of local extension, rather than by producing secondary formations in other organs. On looking over the table of operations (page 450), it will be seen that primary malignant growths are comparatively common in young persons. In a paper in the *Journal of Anatomy and Physiology*, vol. xviii, Dr. Windle collected 37 cases of primary sarcoma of the kidney, the results of which may be summarised as follows:—

"*Sex.*—Out of a total of 37 cases in which this point is noted, 21 were females, 16 males. Amongst spindle-celled tumours, 5 were males, 3 females; round-celled, 4 males, 8 females; rhabdomyomata, 7 males, 4 females.

"*Age.*—It has long been a recognised fact that these tumours are peculiarly obnoxious to infant life, and yet they are by no means confined to it. Thus, the youngest subject in which one was found was a premature child; the oldest, a male of 76. The average for the whole number is a trifle under 10 years and 2 months; but it is very interesting to observe how much it differs in the various forms of the disease. Thus, in the first table (spindle-cells) the average is 23 years (nearly); in the second (round-cells), 11 years 3½ months; in the third (rhabdomyomata), 1 year 3 months; in the fourth, 10 years and 6 months.

"The following analysis shows the number occurring at various ages:—

Number.	Table I.	Table II.	Table III.	Table IV.	Table V.	Total.
Under 1, .	2	1	1	—	2*	6
,, 2, .	—	1	6	1	—	8
,, 3, .	1	2	1	—	—	4
,, 4, .	1	2	2	—	2	7
,, 5, .	—	1	—	—	—	1
,, 10, .	1	2	—	1	3	7
,, 20, .	—	—	—	—	—	—
,, 30, .	—	1	—	1	—	2
,, 40, .	1	1	—	—	—	2
,, 50, .	—	—	—	—	—	—
Over 50, .	2	1	—	—	—	—

* One a premature child.

"From this we learn that 33 of 40 occurred before the 10th year, and of this 33, 26 before the fifth year.

"*Duration.*—This is a factor quite impossible to fix. Such as it is, it simply indicates the length of time which has intervened between the first time the tumour was noticed and the death of the patient. Many, doubtless, if not most, of the cases are congenital; of one there can be no doubt. The period during which the tumour has been known to be growing ranges between a few weeks and three years.

"*Side.*—The left side was attacked in 14 cases, the right in 12, and both in 11. The round-cell and rhabdomyomatous varieties appear to be those in which the disease is bilateral. In the former the left was affected in 2 cases, the right in 4, both in 5; in the latter, left 4, right 2, both 4.

"*Weight and Size.*—This, of course, varies considerably. Speaking generally, these tumours appear to rapidly reach very enormous dimensions."

By inquiring into the literature of the subject, and by examining specimens already classified in museums, I am much struck by the fact that a large number of malignant growths which should properly be placed under the sarcomata are still classified as cancers. This seems to me evident from the Table of Nephrectomies alone. In four cases cancer of the kidney is said to have occurred in children under 6 years of age. I may reasonably inquire, Should these cases not have been named sarcoma?

Congenital sarcomata of the kidney are generally fatal within a few weeks or months after birth. These tumours may, in their structure, be round-celled, spindle-celled, or fasciculated, or they may contain within their substance muscular or adenoid tissue. At first they are encapsuled; but, either from rapid increase in bulk of the tumour or from injury, the capsule ruptures, the cellular elements of the neoplasm become disseminated, and its limits ill defined. In some cases the whole kidney becomes replaced by tumour; but in the majority of instances the renal tissue is more or less distinctly separated from the new formation. The situation in which the tumour originates seems largely to determine the relative position of the renal and tumour tissue. When it commences at the hilus and spreads, it may ultimately form a complete capsule enclosing the otherwise healthy kidney. In such instances the growth appears to extend by the subcapsular lymphatic spaces, very much in the same way as similar growths spread along the visceral pleura or around the heart. Windle describes a case in which the kidney became encapsuled by the growth, in the following terms. He says the tumour was "of an irregularly spheroidal shape, and weighed within a few ounces of 50 lbs. Attached to one edge was the vermiform appendix and caput cœcum coli, containing some soft yellow fæces. At this corner there was a projecting nodule as large as a small cocoa-nut, which gave an indistinct feeling of fluctuation; but the remainder was hard and firm. From the flatter surface a tube hung, on dissecting which the kidney was reached. This was surrounded on all sides by the tumour, though at only a short distance from one surface. On dividing it no divergence from the normal was detected."

Dr. Cullingworth, of Manchester, sent me notes of a somewhat similar case, successfully operated upon by him, in which a primary spindle-celled sarcoma developed from the capsule and cortex of the left kidney of a woman aged 43 (case 66). The central portion of the growth contained four pints of dark grumous fluid, and the tumour and kidney weighed together 11 lbs. 6 ounces.

Again, instead of the growth forming a capsule for the kidney, the kidney may become expanded into a shell surrounding the growth. Abercrombie in the *Transactions of the Pathological Society*, London, vol. xxxi, p. 172, narrates the appearance of such a case. The patient, a child aged 4 years, was admitted into the Hospital for Sick Children under Dr. Cheadle, and died about a month after. The examination of the body revealed the following condition:—

"Both kidneys large, surface smooth; on section, cortex not increased in depth, not pale, not confused; when laid open the whole pelvis presents a deep purple appearance, owing to the presence of a soft purplish mass at the hilus of the kidney; the lining membrane of the pelvis is everywhere quite smooth. The mass in the hilus when viewed from the outside is flattened, about a quarter of an inch thick, and rounded towards the spine. The condition is exactly similar in each kidney; the growth in the one is quite distinct from that in the other; opposite the hilus of the left kidney is a prævertebral gland about three-quarters of an inch long by a quarter across, soft and purple; the corresponding gland on the right side is about one-third of this size and natural. Mesenteric glands enlarged, some of them caseous."

Here is a specimen from the Royal Infirmary Museum, which illustrates very much the same condition. The case was admitted into the hospital under the care of the late Dr. Scott Orr, and was published in the *Glasgow Medical Journal*, vol. xi, p. 55, as one of medullary cancer of the kidney. In reality, however, it proves to be one of round and spindle-celled sarcoma. T. W., aged 6 months, admitted 2nd November, 1878, a healthy looking child till within a few weeks of admission, when he commenced to vomit green biliary looking matter. This passed off, but about eight days before admission the mother noticed abdomen somewhat swollen, and this swelling rapidly increased. On examination, Dr. Scott Orr discovered a round fluctuating tumour in left flank, dull on percussion, and about three inches in diameter. It had all the appearance of a large cyst connected apparently with the kidney, and he proposed to puncture it with a fine trocar, but was dissuaded from doing so on finding that the opinion of his colleagues was against it. The child became gradually weaker and died on the 19th November.

Abdomen very much distended and semi-fluctuant; no dropsy. On opening abdomen a large, full, rounded tumour is seen on left side of belly, about the size of a child's head; over its middle runs the descending colon, which is firmly attached to the tumour, and sessile upon its surface. On removing the tumour carefully, with its capsule, it is found to be in close connection with the left kidney. The left ureter enters the lower and inner part of it, and near this part there is an appearance as if the kidney substance were spread out upon the surface of the tumour for some distance. The left suprarenal capsule is of normal structure, and is not in any way involved. The tumour, being entirely separated, weighs 2 lbs. 2 oz., and its consistence is that of a very fluctuant soft mass, so much so, that it was considered to be a cyst till cut into, when it was observed to be composed of soft cellular tissue of a yellowish and grayish colour, and containing a few small cysts. The tumour appears to have commenced in the interior of the kidney, and to have grown rapidly as from a focus, the remainder of the kidney tissue being distended by it so as to form an imperfect capsule over about a third of the tumour surface. There is, besides, a distinct capsule of thin fibrous tissue round the tumour, and the remainder of the kidney tissue can be peeled off the surface of the capsule.

In a third class of cases the growth instead of being encapsuled, or possessed of moderately clearly defined limits may infiltrate the whole of the renal tissue.

Most frequently sarcomata originate in the cortex, and being firmly encapsuled are clearly separated from the surrounding renal tissue. Commonly, however, the capsule gives way and the growth then spreads with enormous rapidity, and ultimately invades the entire organ. This is most apt to occur when the tumour is rich in cellular elements, as for example in the round-celled variety; hence the greater malignancy of this than of other forms of the disease. Moreover it is the most common variety, and under the name of "encephaloid cancer" has been, and still is, confounded with carcinoma. In appearance the round-celled sarcoma is usually grayish-red, or when deprived of blood, gray, and more or less translucent. The intercellular substance is very small in amount, the blood supply is large, and the vascular lumina, through which it passes, are numerous and possessed of very delicate walls, which are liable to be dilated, and are therefore apt to rupture and give rise to small ecchymoses, or diffuse hæmorrhages. The cells are generally small and round but sometimes they assume a spindle form, and become slightly alveolar in their arrangement. The consistence of a sarcoma is a good indication of the degree of its malignancy. When the cells are numerous and the inter-cellular substance semifluid, the vessel-walls thin, and widely dilated, and the growth is occupied by numerous hæmorrhagic extravasations, it is safe to infer that the degree of malignancy is high.

The spindle-celled sarcomata are composed of more highly developed connective tissue elements, which, from their fasciculated aspect under the microscope and their naked-eye resemblance to muscle have given the name sarcoma (flesh tumour) to the class of neoplasms at present under discussion. These spindle-celled tumours, when contrasted with the round-celled variety, are rarely met with in the kidney.

Cases of primary spindle-celled sarcoma have been reported by Koch, Baginsky, Neumann, Audain, Martineau, Fenoglio, Ignazio, Windle, Bardenheuer, and Cullingworth; but, while so many examples of the disease have been recorded, only in the two last mentioned was an operation adopted for their removal. These growths usually contain a quantity of fluid, which may be of a reddish-brown colour, or may assume a dark chocolate brown hue. The periphery of the tumour is the most compact part, while the centre may be softened and converted into a cyst. Dickinson, on *Renal and Urinary*

Affections, page 779, gives a very interesting and detailed history of a case of spindle-celled sarcoma of the kidney, associated with frequent passage of renal calculi. During the life of the patient there were symptoms of encroachment of the growth upon the spine, leading to paraplegia and dyspnœa from secondary formations in the lungs.

"After death it was found that the central part of the left kidney was entirely replaced by a globular tumour about three inches in diameter, which reached from the pelvic membrane to the capsule, and had destroyed all the central portion of the gland, leaving but a small part at each end, which together amounted to about a fourth of its bulk.

"The tumour was hard, dry, and fibrous, like scirrhous cancer, which at first it was supposed to be. The mass was interspersed with small collections of hæmatin crystals, and specks of cretaceous matter, scarcely large enough to be visible, but tangible to the knife. The bulk, which was thus composed, was separated from the capsule by a layer, about a third of an inch in thickness, of soft recent formation, resembling encephaloid, which was abruptly marked from the inner and older growth.

"Under the microscope, in the fresh state, the tumour displayed a dense arrangement of intersecting fibrous tissue, together with elongated cells in sections. After hardening, it proved to consist of a vast entanglement of spindle-cells, among which small round nuclei could in some places be seen. The spindle-cells were sometimes arranged concentrically around small cavities containing shapeless *débris*. In the softer parts of the growth these cavities were relatively large, and the separating fibroid structure reduced to little more than a substantial network; but no epitheloid or other cells could be discerned in any of the cavities, and it was apparent that the growth, however malignant, had the anatomical character rather of a spindle-celled sarcoma than a cancer, as the term is at present employed.

"The lining of the pelvis was not involved, though the cavity was much compressed in its central part.

"The mucous membrane was much congested, as also was that of the corresponding ureter. The last half-inch of this duct, in connection with the bladder, was intensely vascular, as if recently traversed by a calculus.

"The lumbar glands opposite to the diseased kidney were converted into a mass of soft growth resembling encephaloid, which had eroded and become embedded in the adjacent vertebræ. The bodies of these vertebræ had become infiltrated with this material to such an extent that several were almost destroyed; the body of the last dorsal vertebra was completely cut in two, so that the finger could be passed through a jagged hole, from the erosion in front into the spinal canal.

"The sheath of the spinal cord was covered for about the space of two inches, opposite the affected vertebræ, with a thick layer of soft inflammatory exudation, by which the cord, in this situation, must necessarily have been compressed, though it did not seem to be altered in other respects. The interior of the sheath was natural.

"The right kidney was increased in size to nearly twice its ordinary bulk; the secreting structure was natural in character, and the increase was evidently due to the hypertrophy of compensation. The bladder was much inflamed. It contained a smooth ovoid calculus of the size of a small bean. The liver and the lungs contained numerous soft vascular masses resembling encephaloid which varied in size from that of a marble to that of a chestnut."

The alveolar sarcoma, or sarcoma carcinomatoides of Rindfleisch, is very rarely met with anywhere, and, consequently, is almost never observed as a renal growth. It is of interest on account of its close histological resemblance to the carcinomata—a point to which I have already alluded in the early part of this lecture. I have been able to discover only two examples in which nephrectomy was performed for this variety of tumour. The first case is one published in the *Berl. Klin. Woch.*, No. 23, 1879, by Martin, of Berlin. The patient was a female, aged 53, who suffered from severe and persistent pain in the region of the right kidney, and from retention of urine for three months previous to the operation. At this time the tumour had attained the size of a child's head, and caused considerable displacement of the abdominal viscera. The patient recovered from the operation in 17 days, but unfortunately the growth recurred about a month later. The second case of renal sarcoma carcinomatoides is recorded by Dandois in the *Bull. de l'Acad. Roy. de Med. de Belg.*, 1885, No. 12. It was that of a child aged 2 years. The history of the disease may be briefly stated to be that about five months previous to the operation a slight swelling was noticed in the back, which increased rapidly, was associated with occasional elevations of temperature, and with marked weakness and emaciation, but no urinary trouble, as far as could be discovered. The urine was non-albuminous, and free from any organised deposit, blood pigment, and sugar. When first examined the right side of the abdomen was found to be occupied by a firm spherical tumour about the size of a man's fist. The growth was movable vertically, and could be made to descend as far as the pubes. On percussion, the upper limits of the growth were found to be clearly separated from the hepatic dulness by a clear zone, and palpation showed the growth to be sharply defined on its inner aspect. For diagnostic purposes an exploratory puncture was made, but with negative results. The tumour was removed by abdominal nephrectomy, when it was found to have occupied the lower portion of the kidney, and to measure 27 cm. by 14 cm. The patient made a good recovery.

In some instances the blood-vessels of the tumour become greatly enlarged, while at the same time the growth in the intervascular spaces undergoes a process of absorption, until ultimately the neoplasm becomes little more than a plexus of blood-vessels. To such a growth the term angio-sarcoma has been given.

Two cases (Nos. 12 and 17) have been published, in which a tumour of this nature was removed by operation. In 1879 Lossen (*Deutsch. Zeitsch. fur Chir.*, xiii, p. 199) operated upon a case of renal angio-sarcoma. The patient was a female, aged 37, who was believed to be suffering from an ovarian tumour on the right side of one year's duration. The growth was situated in the right hypochondriac region, in the position usually occupied by ovarian cystomata, and the diagnosis was rendered obscure by the circumstances that no hollow viscera were interposed between the tumour and the anterior abdominal wall, and that the woman was in the third month of pregnancy. Before the operation, the tumour gave rise to great pain. The median abdominal incision was employed, and the tumour was enucleated with ease, but hæmorrhage was so great as to cause syncope, from which, however, the patient recovered. She aborted 12 hours after the operation, and subsequently suffered from septic endometritis and symptoms of carbolic acid poisoning. The ultimate result was, however, favourable, so that in June, 1881, the patient was reported to be well (Czerny, London Congress). The tumour, an angio-sarcoma, was six times the size of a normal kidney.

The second case (17) was a male, aged 51, operated upon by Czerny in April, 1881. The patient recovered from the operation, at which a tumour the size of a man's head was removed, but died in October of the same year with metastatic tumours in internal organs.

Another rare variety of sarcoma met with in the kidney is that in which the sarcomatous elements are interwoven with the glandular tissue of the organ; to this growth the name adeno-sarcoma has been given. Only one case (7) of this disease has been operated upon. Kocher records in the *Deutsch. Zeitsch. fur Chir.*, ix, 312, an interesting and unique example of an adeno-sarcoma of the left kidney weighing 3 lbs. The patient was a male child, aged 2½ years, who from birth suffered from a localised swelling on the left side of the abdomen. The growth was solid, nodulated, and slightly movable. In order to clear up the diagnosis a puncture was made, but with negative results. During the operation of abdominal nephrectomy the neoplasm was found to be bound down by numerous adhesions, the separation of which, together with the division of the renal vessels, caused considerable loss of blood. On account of the opposite kidney having undergone considerable compensatory hypertrophy the secretion of urine continued good, but 24 hours after the patient died from septic peritonitis.

Billroth (case 35) and König (case 62) have each recorded a case in which the sarcomatous elements were combined with those of mucous tissue, and in both the patient made a good recovery. The following is a short account of Billroth's case as published in the *Wiener Med. Wochenschr.*, 1884, No. 25, p. 773:—The patient was a well nourished female aged 38, who for five years had suffered from pain in the lumbar region, which was sometimes excessive. The urine contained albumen, but no tube casts or blood. When the patient was examined by Professor Billroth the tumour had attained the size of a man's head and was believed by him to be a retro-peritoneal fibroma connected with either the uterus or one of the ovaries. The tumour was removed by abdominal nephrectomy, and the patient made a good recovery in about six weeks, without, as far as I can ascertain, recurrence.

In König's case the removal of the tumour was equally successful, but the patient died from recurrence of the growth within a short time of the operation.

These myxo-sarcomata are usually very soft in consistence, present a gelatinous whitish-gray appearance, and on section a quantity of turbid opalescent fluid escapes. The mucous tissue of the growth is composed of a hyaline basis-substance bound together by a fine network of trabeculæ which run into the tumour mass. There are also islands of sarcomatous cells and strands of fibrous tissue, which form cords anastomosing in all directions. Running alongside of these, and into the gelatinous substance of the growth are blood-vessels of various sizes, some of which may have ruptured on account of the weakness of their walls and the inefficient support afforded by the surrounding tissue.

It is a remarkable fact that while myo-sarcomata of the kidney are not very uncommon, cases being recorded by Eberth, Marchand, Williams, Eve, Landsberger, Osler, Huber, Cohnheim, Kocher, Paul, Brodowski, Brosin, Windle, and Smith, not an instance has occurred in which a tumour of this nature has been removed by the surgeon. The great mass of the tumour is generally made up of sarcomatous elements, either round or spindle-celled, interwoven with which are strands of striped muscular tissue; this may be highly developed and enclosed in a sarcolemma, or the muscular fibres may be embryonic in character, and the striation very indistinctly marked.

Myo-sarcomata are congenital growths and develop within a few weeks or months after birth. Cohnheim regards them as due to a faulty segmentation of the primitive muscular plates, whereby some of the cells become included in the rudimentary kidney, as it develops from the intermediate cell-mass lying between the mesoblast and the anterior part of the protovertebral column. The fœtal deposits of muscular elements in the rudimentary kidney may, if time permits, attain a high state of development by a process of evolution. The growth may either be unilateral or bilateral, and in many cases it has attained very great dimensions; for example, Dawson Williams records in the *Transactions of the Pathological Society of London*, vol. xxxiii, p. 317, a case in which a renal tumour, containing striated muscular fibre, weighed 29½ ounces, and Paul, in the *British Medical Journal*, 1884, vol. i, p. 51, describes a myo-sarcoma which weighed twelve pounds. In the latter the tumour had "displaced the kidney, and subsequently infiltrated it, though with round cells only. The great mass of the tumour was a round-celled growth, but the outer part had a dense and fibrous appearance. The round cells of the more central part could be traced gradually developing into striated muscular fibres, of which the fibrous part consisted. The muscular fibres in all the specimens were very embryonic in character, and not generally more advanced in development than what is observed in the third month of intra-uterine life."

Passing now from the consideration of individual renal tumours, a number of other general points in connection with these growths present themselves to our notice. The etiology of benign growths, such as fibroma, lipoma, and adenoma, is not known, partly on account of the rarity of these diseases, and partly because of the great difficulty of the inquiry. In cases of malignant disease also the presence of the neoplasm cannot be referred to any definite cause.

The only circumstance which is known to exercise any influence upon the development of malignant renal disease is local injury, resulting from contusions, or from the presence of a renal calculus. Mangolini has reported a case in which a child, having sustained a blow upon the left lumbar region, immediately suffered from hæmaturia, and ultimately developed an encephaloid cancer (?). Bright also mentions a case in which a malignant growth appeared in the kidney three months after a fall, and other similar instances have been placed on record by W. Brinton and Jerzykowsky. The presence of a renal calculus has also been observed to be coincident with the formation of a growth in the kidney. To such a case I have already directed your attention (page 371). It was one which came under the observation of Dr. Dickinson, who, in writing on this subject, remarks, "Pathology abounds with instances in which malignant and other growths have been started by accidental irritation; cancer of the gall-bladder from biliary calculus is a parallel instance to the cases in which the pelvis is the seat of the villous or other growth sequent upon renal stone; cases where the growth has been apparently in the substance of the organ, are less easy to explain as a result of pelvic irritation; but that stone is more often a precursor of renal growth than can be explained by chance concurrence is certain."

For my own part, I am more willing to believe that renal calculus may be a cause of malignant growth, than I am to admit the influence of blows and contusions in the renal region. Proof appears to me to be still wanting to convince us that injuries to the kidney are sufficient to cause renal cancer. Every pathologist knows, however, that prolonged mechanical or chemical irritation frequently determines the seat of cancer. Instances are too familiar to require mentioning, but I hold it may be stated as a general, if not invariable rule, that it is prolonged and comparatively slight, rather than intense and transitory irritation that predisposes to the development of a carcinomatous growth.

The influence of age as an etiological factor in certain tumours has already been fully considered (pages 360 and 380), and that of sex may be now briefly alluded to. According to Roberts, males are more liable to renal cancer than females. This disproportion he tries to account for by the marked preference shown by cancer for the generative organs of the female. He states that out of 66 cases, 47 were males and 19 females, and that of 24 children, 15 were boys and 9 girls; of 42 adults, 32 were men and only 10 women. Ebstein, in his statistics, gives very similar results; he states that out of 56 cases in which the sex was given, he found 38 men affected, and only 18 women, and among 15 of children, there were 8 boys and 7 girls. Lebert places the proportion of males to females as 7 is to 4, and Rosenstein as 22 to 13. In the 24 cases of operation which I have collected, where the sex is stated, I find 13 males and 11 females. Taken collectively, the figures which I have just quoted, show that, out of 192 cases of cancer of the kidney, 127 were males and 65 were females, that is to say, the ratio was about as 2 is to 1. It is a fact of interest in this connection, that of the 30 cases of sarcoma operated upon, and included in my table, exactly the opposite condition holds—namely, that 20 females were affected with the disease, and only 10 males.

Beyond the facts which I have just brought under your notice, little or nothing is known concerning the exciting or predisposing causes of renal growths, malignant or benign; not even heredity has been shown to exercise any influence.

The duration and prognosis of tumours of the kidney depend largely upon the kind and variety of the growth. The simple benign tumours, when removed successfully, do not recur, and the prognosis is favourable. When the neoplasm is a round-celled sarcoma, or an encephaloid cancer, not only is its development rapid, but the prospect of life being prolonged beyond a few months is poor. Yet Czerny (case 15) reports an instance in which a congenital round-celled sarcoma existed for thirty years before the operation, from which the patient died, was called for, and the same surgeon had under his treatment (case 10) a patient in whom a growth of similar structure made its appearance two years previous to death, and another (case 33) of encephaloid cancer, where the duration of the disease was three years. The most prolonged period during which an encephaloid cancer endured, was in Walcott's patient (case 1), where it was known to be present for six years, by which time it attained a weight of 12 lbs.

It is not always easy to fix precisely the real duration of the disease; all that can be estimated is the time which has elapsed since the function of the organ became impaired, or the presence of the tumour became manifest by pain or swelling. Probably on this account many authors do not state the duration of the disease, but of the cases of encephaloid cancer and round-celled sarcoma in which a time is named, of the former one case (24) lived for two years, and another (14) for eight months. In Jessop's (No. 6) and Byford's (No. 8) cases the disease existed for twelve and eighteen months respectively previous to the operation of nephrectomy, from which the patients recovered. Of the patients suffering from round-celled sarcoma, in one (case 31) the disease was only discovered two months previous to operating, and in the other (case 66) twelve months had elapsed, when the growth weighed nearly twelve pounds, but notwithstanding this the patient made a good recovery.

As a general rule it may be said that when the malignant tumour is rich in cellular elements of a low type of development, its growth is rapid, and the course of the disease is short. Hence it is that in children the tumour is usually soft, and in them its malignancy is more marked than in adults. According to statistics given by Roberts, in children the mean duration of cancer of the kidney is nearly seven months, the minimum ten weeks, and the maximum over a year. In the case of adults the average is two and a half years, and the extremes from five months to seven years. Dickinson states the duration of malignant renal growths as follows:—

DURATION OF MALIGNANT GROWTHS.

From First Symptom to Death.	Children—13 Months to 4 years.	Adults—25 Years to 58 years old.	Total.
Under 6 Months, ...	4	2	6
From 6 Months to 1 Year, .	2	4	6
From 1 Year to 2 Years, . .	—	1	1
From 2 Years to 3 Years, . .	—	1	1
From 3 Years to 4 Years, . .	—	1	1

When we were engaged studying the general symptomatology of surgical diseases of the kidney, I indicated to you the distinguishing features of a renal swelling, whether the increase in bulk of the organ be due to the presence of a tumour, or to a distention of the organ by fluid accumulations (page 96). The latter are more apt to lead to an erroneous diagnosis than the former. But while hydronephrosis and pyonephrosis have been mistaken for hydatid cysts, cysts of the liver, of the spleen, or of the ovaries, true tumours of the kidney have been likewise diagnosed as of splenic, ovarian, or hepatic origin. The great difficulties which one has to contend with will be appreciated by you when I state that such well known, experienced, and careful surgeons as Czerny, Hueter, Thornton, Claus, Cullingworth, Thomas, Lossen, Peaslee, and Walcott, have mistaken tumours of the kidney for cystic disease of the ovaries, hydronephrosis, or cystic disease of the liver. In my table of nephrectomies (page 450) eight examples are given in which the first mentioned error occurred. It must, therefore, be regarded as the one of greatest practical importance. The differential diagnosis, in so far as these difficulties are concerned, has been fully discussed (page 99), but I have still a few remarks to add respecting the particular symptoms to be looked for in order that we may distinguish one renal tumour from another.

Little reliance can be placed upon physical signs; the diagnosis must rest essentially upon subjective phenomena. If the renal growth be unaccompanied by interference with the general health, hæmaturia, pyuria, or severe pain in the lumbar region, and if the increase in the renal swelling be slow, the presumption is that the growth is benign, and if removed by operation, will not recur.

Non-malignant growths seldom cause any discomfort or interference with function further than what may be the direct or the indirect result of pressure—*e. g.*, a dull, dragging, sickening pain in the loin, loss of appetite, nausea, chronic dyspepsia, and interference with the action of the bowels or urinary bladder. But while the diagnosis, as between malignant and benign neoplasms, is not attended with great difficulty, the symptoms which distinguish the malignant tumours from one another are so unreliable, that, previous to the operation, the precise condition of the kidney can only be surmised. It is remarkable, however, to find in how many instances an absolutely correct diagnosis was arrived at previous to the removal of the growth; in not a few cases, however, sarcomata and medullary carcinomata have been mistaken for one another. But this is an error not limited to the observations of the clinician. Many writers on the subject contend that clinically the two varieties of malignant tumours are not distinguishable from one another. This opinion cannot be now accepted, as on examination of those cases in which the diagnosis has been verified by an operation, it is found that, out of 31 examples of malignant disease in which a definite name was given to the growth previous to its extirpation, in 25 instances the designation carcinoma or sarcoma was correctly applied, while in 5 cases a cancerous growth was named sarcoma, and only in 1 was a sarcoma by mistake called cancer. In receiving this statement, it must be borne in mind that in many of the cases of nephrectomy no specific name was given to the tumour previous to operating, the diagnosis being simply stated to be "renal tumour," "malignant tumour," &c. Within recent years, much care has been taken by surgeons to distinguish, as far as possible, between cancer properly so called, and sarcoma; but, in the earlier literature of the subject, "malignant disease" and "cancer" are used as synonyms.

The clinical signs and symptoms which distinguish carcinomata from sarcomata are by no means definite, so that the diagnosis is admittedly difficult. The two conditions are to be recognised by a careful consideration of the facts of the individual case, as compared and contrasted with those revealed by a study of the cases already published.

The differences in the symptoms of sarcoma and those of cancer will be found to be one of degree rather than of kind. Hence, we observe that all the symptoms which I have described to you as those of malignant disease are recognised in one disease as well as in the other, but while this is admitted, it must also be pointed out that there are certain differences. What these differences are I shall now indicate to you in a general way. First, in respect to age, you will find it usually stated that sarcoma is more frequent in children than carcinoma, and that the disease is one of middle adult life rather than of old age. If you examine the results shown in the table of nephrectomies for renal tumours, you will find that taking the cases of carcinoma, the mean of 23 cases in which the ages are given shows the average age to be 40·7 years. But if from this we deduct 4 doubtful cases (Nos. 6, 28, 34, and 50, the maximum age of which is 5½ years) the mean age of the remaining 19 cases will be found to be 48·5 years. Looking now to the cases of sarcoma, in an average of 30 cases the mean age may be stated as 31·2 years, but on looking more carefully into these figures it will be found that the lower average in the cases of sarcoma is due to the larger proportion of cases under six years of age, for if these be deducted the average of the remaining 19 cases is almost exactly the same as in the cases of cancer—namely, 47·5 years.

The following table shows the relative number of cases at different ages:—

	Cancer.	Sarcoma.
Between 1 and 5 years, . . .	2	10
" 5 " 10 " . . .	2	1
" 10 " 20 " . . .	0	0
" 20 " 30 " . . .	3	1
" 30 " 40 " . . .	5	6
" 40 " 50 " . . .	3	7
" 50 " 60 " . . .	5	5
" 60 " 70 " . . .	3	...
	23	30

The only information derived from these figures is that sarcoma is relatively frequent in children under five years, and that after that age the two forms of malignant disease are most commonly met with between the ages of 30 and 60.

While such symptoms as œdema of the feet and legs, ascites, feeling of weight or pain in the loin, anorexia, vomiting, &c., are just as frequently met with in sarcomatous disease, arising in consequence of the mechanical pressure of the growth, as when the kidney is occupied by a cancerous growth, still, it may be asserted that as a rule these troubles are less severe in the former disease than in the latter, and in some cases of sarcoma may be entirely wanting. Again, sarcoma occurring in the adult differs from cancer, in that the disease develops more slowly, is not so often associated with hæmaturia, and does not give rise to such a marked failure of strength, loss of flesh, and change of colour. Further information may be obtained by a physical examination from one circumstance, that while the sarcomatous tumour is usually very regular in form, and has a smooth surface, the cancerous growth is commonly irregular in outline and nodulated. The character of the urine may assist the diagnosis if portions of the tumour become detached and escape from the bladder.

The symptoms of malignant tumours are: swelling in the renal region; lumbar pain; the effects of pressure upon neighbouring parts; certain alterations in the character of the urine; cachexia, and signs that the disease has extended beyond the kidney and invaded other organs.

The presence of a palpable swelling in the loin is an almost constant sign of carcinoma or sarcoma of the kidney. The relationship which the tumour has to surrounding parts has been already indicated to you in a former lecture. But while, in the great majority of cases the renal growth is easily felt with the hand during life, in a certain number of instances the patient may die of generally disseminated disease without the primary growth of the kidney being detected. The mode in which the enlargement extends depends upon the part of the kidney primarily involved; as a rule, however, the tumour is most distinctly felt from the front.

Pain in the loin is usually the first symptom which attracts attention, and induces the surgeon to make an examination of the loin. In malignant disease the pain is more severe in the situation of the affected kidney, but, especially in the later stages of the disease, it may extend to distant parts. In character it is dull and aching, and may be paroxysmally increased, though not by movements of the body as in renal calculus. The suffering of the patient is generally more severe in scirrhous cancer than in acute carcinoma or sarcoma, and is frequently increased by the pain and difficulty in micturating which is so often associated with malignant growths of the kidney, even although the bladder is free from the disease. The pain presents great differences in its character: it may be at first slight, vague, and not constantly present, at other times entirely absent, or severe and prolonged. In not a few instances the sense of discomfort in the lumbar region is the first indication of disease. Gradually, as the tumour increases in bulk, the suffering of the patient becomes more intense and more constantly present. At first dull in character, later it becomes lancinating, and may either arise spontaneously or be provoked by pressure, but is seldom aggravated by movements of the body. When the tumour has attained considerable dimensions, or has invaded the tissues around so as to involve or compress the nerve trunks, the pain, instead of being limited to the lumbar region or hypogastrium of the affected side, may extend to the chest, across the middle line, or to the hip and lower extremities, which may lead to the disease being mistaken during this stage for sciatica or rheumatism.

In malignant disease of the kidney when the tumour is limited to the substance of the organ, the urine is usually perfectly natural; but when the neoplasm has invaded the pelvis, blood, albumen, blood casts, epithelium, or portions of the growth may appear in the excretion. In the early stage of the disease, however, even before any abnormal constituent can be detected in the urine, the patient may experience considerable difficulty in micturition.

Hæmaturia is perhaps one of the most important and significant symptoms of malignant disease especially cancer of the kidney, but its value as an indication of the nature of the malady from which the patient is suffering is greatly reduced by the circumstance of its being a symptom of many other renal affections; for example, calculus, hydatids, tubercular disease, pyelitis, &c. To discuss now the points which distinguish hæmaturia from tumours of the kidney from renal hæmorrhage from other causes, would be only to repeat what has already been said in a former lecture (page 86). Hæmaturia of malignant disease is rarely severe at an early stage, although cases have been recorded in which profuse bleeding occurred. As a rule, however, it is only as the disease advances that the loss of blood attains to such an amount as to form a distinct deposit. When the hæmorrhage has commenced, it is more profuse and less transient than when due to other causes; it is generally spontaneous, and continuous, although at intervals liable to aggravation. At these times clots may form, and cause obstruction to the escape of urine from the ureter, bladder, or urethra, and may consequently resemble traumatic hæmaturia.

The presence of organised constituents in the urine, such as epithelium, tube casts, &c., is of comparatively little value, although, by some observers, considerable importance has been attached to the presence of so-called "cancer cells." As a matter of fact, however, cells resembling those of a cancerous growth seldom find their way from the kidney to the bladder; in this opinion I entirely agree with Dickinson, who says, "I have met with not a few in which a discharge of cells of epithelial type, together with blood, has been supposed to indicate cancer of the kidney, but not with one in which this supposition has been verified. If I am told that such an one is passing 'cancer cells' in the urine I conclude that, whatever his disease may be, it is not cancer of the kidney. A deposit consisting of blood-corpuscles, mixed, if with anything, with indefinite sanguinolent material, and that constant, during repose as well as under exercise, is a sign in this respect of more meaning. It is to be borne in mind that a fungating tumour of the kidney is less often cancer than sarcoma, the cells of which, associated as they are with connective tissue, are not to be easily and abundantly shed, while even should they reach the urine they are, at least in the small-celled varieties which are the more numerous, too small to attract attention when confused with red and white blood corpuscles."

The presence of loose epithelial cells does not signify the nature of the renal affection (see page 205), but if you succeed in discovering small portions of the neoplasm in the urine, their examination under the microscope will clear up the diagnosis.

When the malignant growth has attained such dimensions as to cause pressure upon neighbouring parts, it may, by interfering with their function, assist the clinical observer to form a reliable opinion. For example, should the tumour come to press upon, or involve the lumbar nerves, it will cause the patient extreme suffering, which may be referred to different parts of the body at various times, to the chest, the lumbar region, back, hip, testicle, thigh, or leg.

Again, should the pressure be exerted upon the veins within the abdomen, œdema of the lower extremity, ascites, or dilatation of the superficial veins may result, from occlusion or thrombosis of the intra-abdominal vessels. On the other hand, the functions of the abdominal viscera may be interfered with, as indicated by vomiting, constipation, anorexia, icterus, &c.

The constitutional effects of cancer, as indicated by loss of flesh, anæmia, and change of colour, are most significant, especially when the patient is taking food reasonably well, and has not been suffering from much loss of blood. In sarcomatous disease this constitutional disturbance or so-called "cachexia" is not marked.

Respecting the treatment of benign renal tumours little can be said. The cases on record are so few in number that no definite conclusions can be stated. As far as operative treatment is concerned, taking cases of fibroma, fibro-myoma, fibro-lipoma, fibro-cystoma, adenoma, and papilloma, of 12 cases, 3 died from the effects of the operation (2 from peritonitis, 1 from shock), and the others made a good recovery.

Turning now to the treatment of malignant growths, I may preface my remarks by recalling to your memory the circumstance that malignant disease of the kidney may remain localised for a considerable period, and that it is by taking advantage of this circumstance that the surgeon may hope to celebrate his triumphs in a sphere in which medical science is inoperative.

From a careful consideration of the details of the cases which have been published, it appears to me that much of the want of success which has attended the operations performed up to the present time has arisen as a consequence of delay of the operation. As in tubercular disease, so also in malignant neoplasms, a diagnosis made early, and an operation promptly and efficiently performed are the elements of success. In those instances in which the disease has extended beyond the kidney operative interference is contra-indicated.

The difficulty in malignant disease is not the removal of the kidney, but to know when to remove it, and in answer to this I have only to say that as soon as the surgeon is satisfied that the disease is cancerous or sarcomatous he should make an exploratory incision, and if found necessary remove the kidney. The great difficulty one has to contend with is, that before the neoplasm has attained such a size as to be palpable through the abdominal wall it usually forms secondary formations in other parts of the body. Hence it is necessary to form a diagnosis by a careful consideration of the subjective phenomena, rather than to rely upon the physical signs, which even in the best circumstances do not assist one much in the more refined points of diagnosis.

For cancer of the kidney, Walcott (in 1861) was the first surgeon to perform nephrectomy, and this he did under the belief that he had to deal with a case of cystic disease of the liver. The growth weighed 2½ lbs., and the patient died, fifteen days after the operation, from suppuration and exhaustion. Since then 25 operations have been performed for cancer alone and 36 for sarcoma.

Of the 25 cancerous cases 14 died (9 males and 4 females, 1, sex not stated), and 11 recovered (4 males and 7 females). And of the 36 sarcomatous cases 19 died (6 males and 10 females, and 3, sex not stated), and 17 recovered, that is to say, that out of 61 nephrectomies for malignant disease 33 patients died from the effects of the operation.

Considering the serious nature of the disease, and, without operative interference, its necessarily fatal issue, the results I have just stated, could we be assured that the disease can be eradicated, would justify the operation of nephrectomy for malignant neoplasms of the kidney. But that the patient has recovered from the operation is no guarantee that he is cured of his disease. Hence you will find by looking into statistics of the subject, that in not a few cases the patient is known to have died from recurrence of the disease; to conclude that in the others a permanent cure was attained would be, I fear, a mistake. In many cases, however, although the operation has not succeeded in the highest degree, it has at least been the means of prolonging considerably the life and alleviating the suffering of the patient.

The question of whether or not an operation should be performed must rest entirely upon the circumstances of the individual case and upon the opinions held by the surgeon.

The following table shows the results of the operation of nephrectomy for cancer:—

NEPHRECTOMIES FOR CANCER.

	Males.	Females.	Sex not stated.	Recoveries.	Deaths.
Lumbar, . . .	5	4	—	7	2 = 22·2 °/.
Abdominal, . .	8	6	—	3	11 = 78·5 °/.
Operation unknown,	—	1	1	1	1
	13	11	1	11	14 = 56 °/.

NEPHRECTOMIES FOR SARCOMA.

	Males.	Females.	Sex not stated.	Recoveries.	Deaths.
Lumbar, . . .	5	3	—	5	3 = 37·5 °/.
Abdominal, . .	5	17	3	11	14 = 56 °/.
Operation unknown,	1	—	2	1	2
	11	20	5	17	19 = 53 °/.

The causes of death in cancer and sarcoma are as follows:—

	CANCER.		SARCOMA.		Total.
	Abdominal.	Lumbar.	Abdominal.	Lumbar.	
Shock and Collapse, .	4	—	4	1	9
Pyæmia, . . .	—	—	—	1	1
Uræmia, . . .	2	—	—	—	2
Peritonitis, . . .	4	—	5	—	9
Pulmonary Thrombosis,	1	—	—	—	1
Strangulation of Bowel,	—	—	1	—	1
Recurrence, . . .	—	1	—	—	1
Pulmonary Œdema, .	—	1	—	—	1
Hæmorrhage, . .	—	—	2	—	2
Tetanus, . . .	—	—	—	1	1
Cause not stated, . .	—	—	2	—	2
	11	2	14	3	30

In three cases (Nos. 23, 30, and 67) the nature of the operation is not stated, and in two (Nos. 20 and 52) the cause of death is not given. Esmarch's case (No. 23) died on the eighth day from intestinal perforation, while Heath's (No. 30) never recovered from the effects of the operation, and expired ten hours after from collapse, and Chiene's patient (No. 67) died with the symptoms of suppression of urine.

When operative treatment is inapplicable the object of the surgeon must be to palliate as far as possible the agony of the unfortunate sufferer, but how this is to be done it is not necessary for me to do more than indicate in a very general way. What one has to deal with is the danger of death from hæmorrhage, and the suffering of the patient either as a consequence of the direct pressure of the tumour, or as a result of the involvement of the neighbouring nerves.

Respecting the treatment of renal hæmorrhage, the best results are derived from complete rest, the application of cold to the lumbar region, and the internal administration of such astringents and sedatives as are usually employed for the arrest of bleeding.

Pain may be relieved somewhat, but unfortunately not very satisfactorily, by the application of belladonna or aconite liniments, by a mixture of hydrate of chloral and camphor, by the subcutaneous injection of acetate of morphia, or by the administration of opium by the rectum. In respect to the general symptomatic treatment nothing more need be said now.

Before concluding this course of lectures I desire to call your attention first to the operations performed for diagnostic purposes, and second to those which are resorted to for the relief or cure of disease.

The operations which have been performed for the purpose of enabling the surgeon to form an exact and reliable opinion regarding the nature of the malady from which his patient is suffering are three in number—namely, (1) compression and catheterisation of the ureters; (2) aspiration and puncture of the kidney; and (3) exploratory incision through some portion of the abdominal wall.

Before entertaining the question of an operation upon the kidney, especially nephrectomy, it is necessary to establish beyond doubt that the kidney on the opposite side is healthy. The most exact method of determining this is to procure by some means separate samples of urine from each ureter. This may be done in two ways—either by catheterisation of the ureters, or by compression of one of the ureters, while the other is allowed to remain patent. The method recommended by Glück, to ligature the ureter of the diseased kidney, to inject hypodermically a solution of iodide of potassium, and to examine the urine passed from the kidney supposed to be healthy, although a certain method, is a very dangerous one.

There are four methods by which the ureter may be compressed—(1) by pressing on it by the hand or a rounded lever in the rectum, as it crosses the common iliac artery on the left side, or the external iliac on the right side; (2) as suggested by Polk, by occluding the ureter between the finger in the rectum, and a catheter in the bladder; (3) by compressing the orifice of the ureter by means of Tuchmann's ureter forceps introduced into the urinary bladder; and (4) by pressing the ureter, as it passes through the wall of the bladder, by a tampon introduced into the bladder and subsequently filled with mercury.

The method first mentioned of compressing the ureter by means of a lever introduced into the rectum has been advocated by Mr. Davy, but it has the disadvantage that it is not always applicable in consequence of the shortness of the mesentery of the rectum in some cases.

The second mode of procuring a specimen of urine from one kidney—that suggested by Dr. Polk—is more easy of application, and more likely to yield accurate results. Dr. Polk describes it as follows:—

"The method I have to suggest is, to compress the ureter. I confess it is easier of performance in the female than in the male, but I believe it can be accomplished in both. Take a large catheter, made of some substance like block tin, bend it to the shape of a Sim's sigmoid catheter; let the curve that passes into the bladder be as decided as it can be made, and yet not so great as to interfere with the ready passage of the instrument into the bladder. Suppose it to be the right ureter you desire to close. Introduce the instrument; then place the patient in the lithotomy position. Now carry two fingers as far into the rectum as possible.* Now place the catheter so that its curve in the bladder hugs the right pelvic wall; the end of the curve will pass directly across the line of the right ureter. Now press the fingers against the catheter, and the ureter will be sufficiently occluded to prevent all escape of urine. By means of the catheter in position (it may be double) you thoroughly cleanse and empty the bladder. As fresh urine flows in from the other ureter, it can be withdrawn and tested. As urine from a sound kidney is secreted at about the rate of a minim in four or five seconds, it will not require long continued pressure to secure the amount of urine necessary for satisfactory examination. In the female the procedure is more certain of accomplishment than in the male, because we can, in a measure, fix the base of the bladder by traction upon the anterior vaginal wall by means of a tenaculum hooked into it just below the cervix, or, better, well to the right of the cervix, on the lateral wall, the traction being downward and to the patient's left."

Dr. Tuchmann devised an instrument resembling a lithotrite, with which he seizes the lower end of the ureter; and which may be used, as described by Morris in the following words—

"It is like a lithotrite, but more slender; its branches are made to approach each other not by the force of a screw, but by a slight spring; it has large holes to allow the urine to flow out from the bladder.

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* An instrument curved and grooved to receive the catheter might be substituted for the fingers for counter-pressure.

"The instrument has the purpose, when introduced into the empty bladder, to close during a certain time the valve of the ureter of the one kidney, and to collect the urine which, during this time, comes down from the other kidney.

"In the empty living bladder the valves of the ureters are very prominent; they are also in a fixed position relative to the opposite part of the posterior wall of the bladder, which wall here, near the bottom of the bladder, is very inextensible and cannot be pushed back more than half an inch.

"The branches of the instrument, when drawn asunder, leave a space of a little more than half an inch between each other, so that when the instrument is pushed towards the posterior wall of the bladder, the valve is getting between the two branches.

"Besides this, we have various anatomical and physiological guides which show us that we are on our right way and have succeeded in our design; these signs are:—

"(1) A certain feeling of resistance which informs us that we are on the bottom of the bladder.

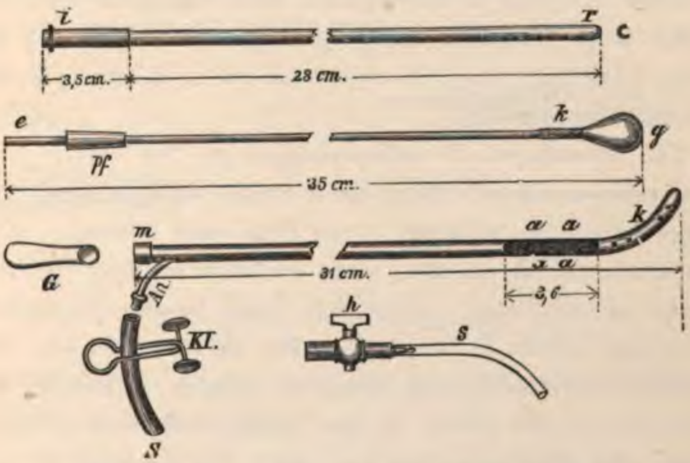
"(2) More certain still in this respect is the peculiar feeling which we get when the beak of the instrument passes over the base of the trigone.

"(3) The part immediately behind the valves is comparatively narrow in the transverse direction, so that when we move the branches sideways towards the origin of the valve, we are very soon arrested by the lateral wall of the pelvis, whereas the higher regions of the bladder are much wider.

"(4) The instrument is quite immovable when we have seized the valve.

"(5) When the valve is really closed a much smaller quantity of urine appears, and when we after some time let it go the large quantity of urine streaming out is very striking."

The fourth method is the one which I have most frequently employed, and cannot but regard as the most satisfactory. The idea of compressing the orifice of the ureter by means of an india-rubber balloon filled with mercury was suggested to Silbermann by finding one of the ureters compressed by a fibroma of the bladder, which obstructed the vesical orifice of the right ureter, and induced a hydronephrosis. Silbermann's instrument is easily employed in women, and with care may be used also in men. It consists of a catheter (*k*, *m*) 31 cm. long, with a sharp curve (at *k*), at the termination of which there is a window (*aa*) 3·6 cm. long. It can be closed by passing a shutter (*l*, *r*), which is the half of a straight tube divided longitudinally, into the catheter. Before passing the instrument into the bladder an india-rubber balloon (*g*), attached to a gum elastic tube (*e*, *k*), is carefully packed inside the catheter (*m*, *k*), so that the expansible balloon corresponds in position to the opening (*aa*), and the opening is closed by the shutter (*l*, *r*). The



instrument can then be introduced into the male or female bladder with ease. Before passing the instrument the bladder should be carefully washed out, and a vulcanite pessary, an inch and a quarter broad by five inches long, should be introduced into the vagina of the female, or the rectum of the male. By withdrawing the shutter the window is opened, and the balloon springs out of the opening. By means of a syringe mercury is poured into the balloon until it is the size of a hen's egg. The weight of the mercury is sufficient to compress one ureter as it passes through the wall of the bladder, while the urine from the other is permitted to escape through the catheter by the tube (*An*) and may be submitted to a microscopic and chemical examination.

The advantages of catheterisation of the ureters over the compression of them, as a means of procuring two separate samples of urine — one from each kidney — seem apparent. If the ureters were constant in their position under all conditions, compression would be easy of application and certain in its results. But they are not so. The state of the bladder and bowel, as regards expansion, the situation of the uterus in the female, individual peculiarities, and other circumstances, alter the relations of the ureters, so that the operator might imagine that he was occluding one of them, while all the time the urine from both kidneys was flowing into the bladder.

Simon was the first to propose catheterisation of the ureters in females, and although not always successful, in many instances he derived valuable information when he managed to introduce the instruments into the ureters. To perform such a delicate operation by the sensation of touch alone is very difficult, and it is only by patient and prolonged practice on the dead subject that one can hope to succeed in performing the operation on the living; but once the art has been mastered it is easier to pass a catheter into the living ureter than into the dead one.

This may be done with or without the electric light. Early in 1883 I devised and used an electric endoscope and ureter catheters,* and found that when the bladder is well illuminated, the orifices of the ureters are easily seen, as narrow oblique slit-like openings, about 2 inches apart from one another. These openings are situated at the posterior angles of the trigon, nearly 1½ inch from the inner orifice of the urethra, and are united by a curved elevation, which, however, extends a little beyond them. The elevation referred to corresponds in position to the anterior lip of the os uteri externum.

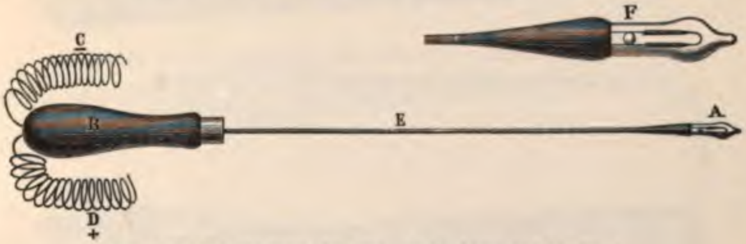


Fig. 1—F. Electric lamp, full size. A, B. Lamp and handle, ½.

The method which I adopted was to introduce into the bladder a small electric lamp connected with a battery composed of two Grove's cells. The electric lamp (Figure 1, A) is connected with the handle (B) by a thin rod (E) in which the wires from the battery run. The lamp, when connected with two Groves' cells, gives light equal to one candle.

The rest of the apparatus consists of a speculum and the catheters. The speculum is represented in Figures 2 and 3. It is a hollow cone, made of vulcanite, the apex (H and J) of which is movable, and the small end of the remaining portion (G) is closed with a small glass disc. The apex is rotated out of its place by a handle (L).

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* *Glasgow Medical Journal*, August, 1883.

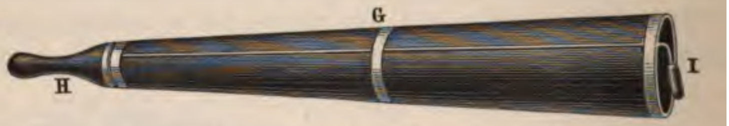

FIG. 2.—Speculum, G. Cover (to protect glass disc and facilitate introduction) in position, ready for introduction into bladder. Size, ⅔.

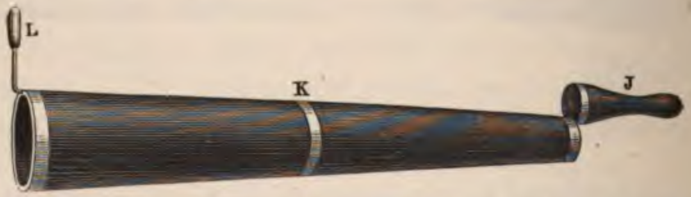

FIG. 3.—Cover (J) rotated by handle (L). In position after it has been introduced into bladder. Size, ⅔.

The method of using these instruments is as follows:—The bladder is first washed out with a warm solution of boracic acid, so as to remove all the urine. It is now distended with eight ounces of the boracic acid solution, and the electric lamp is introduced through the urethra without being connected with the battery. It is important that the lamp should be introduced before the circuit is completed, as if this precaution be not taken, the lamp is apt to become heated, and may crack when it is passed into the fluid contents of the bladder. Two gum-elastic catheters (No. 2) should now be passed, and after them the speculum is introduced with the cover (H) in position, as represented in Figure 2. The current is now passed through the lamp, the cover (J) of the speculum is rotated, as represented in Figure 3, and on inspection the structures forming the floor of the bladder are easily seen. The speculum should be passed so far into the bladder that the small end, closed by the glass disc, is about a quarter of an inch beyond the inner orifice of the urethra. The ureters are easily seen, and may be catheterised. The bladder is then allowed to empty itself, the catheters being retained in position, and the urine drawn off from each kidney separately. This method is of course only applicable to female patients, but may be used for any purpose where it is found necessary to examine the interior of the bladder.

In some female cases, and in a few males, catheterisation of the ureters may be performed, without the use of the electric light, by employing the catheters I am about to describe to you, and which are illustrated in Figures 4 and 5.

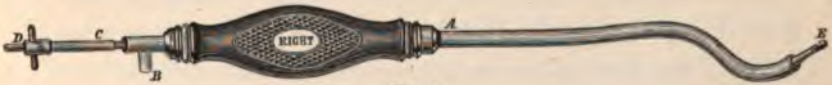

FIG. 4.

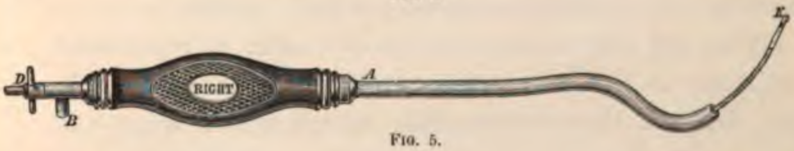

FIG. 5.

The instrument consists of two parts, a metal tube or holder (A) and a small gum-elastic catheter (D.C.E). The holder is so curved that when the instrument is introduced into the bladder and the handle held perpendicularly in the middle line the inner extremity of the catheter (E) points to the orifice of the right ureter. The method of using this instrument is as follows:—In the female while the patient is lying upon her back, (the operator having previously washed out the bladder and distended it with eight ounces of warm boracic acid solution) the surgeon introduces into the vagina the index and middle fingers of the left hand, and places them with the palm or surface upwards on either side of the os uteri externum. The points of the fingers then occupy a position posterior to the upper angles of the trigon, and are therefore immediately behind the vesical orifices of the ureters. The catheter holder with the catheter in the position represented in Figure 4 is now introduced into the bladder, and a careful search is made for the opening of the right ureter as it lies over the point of the index finger. The extremity of the catheter (E) is known to be within the orifice of the ureter by the operator feeling that he is able, as it were, to hook up the vesical wall and lift it away from the index finger. When this has been done the handle (A) is held in a fixed position, and the catheter is pushed through it to the position represented in Figure 5.

To the side of the holder a tube (B) is attached and from it an india-rubber tube communicates with a glass vessel. To the catheter (D) another small india-rubber tube is fixed which communicates with a syringe.

When the catheter is placed in the holder, as represented in Figure 4, the metal shod (E) on the catheter prevents the fluid in the bladder from escaping, but when the catheter is passed into the ureter, the fluid may flow through the holder and escape by the side tube (B) unless the india-rubber tube connected with it is clamped. That is to say, the surgeon after passing the catheter into the ureter may either allow the bladder to remain distended, or he may empty it, in which case after a short time he will procure a quantity of urine from the ureter on the left side. Through the tube attached to the catheter (D) the urine from the right ureter may be slowly drawn off by the syringe. To catheterise the left ureter a similar instrument is used but with the curves reversed.

I have successfully employed these catheters, which were made for me by Messrs. W. B. Hilliard & Sons, of this city, in a number of female cases and in a few males; but while in the majority of cases a satisfactory result was obtained, in a considerable number of examples of renal disease, especially in calculous pyelitis and in renal tuberculosis, the bladder becomes so changed by disease that not only does the patient seriously object to instrumental manipulation, but the difficulties attending the operation of catheterisation of the ureters are so increased that the results obtained are unreliable.

Aspiration and puncture of the kidney have been frequently employed for both diagnostic and remedial purposes in such conditions as cystic degeneration of the kidney, hydronephrosis, pyonephrosis, and hydatid disease. But while aspiration and puncture with the trochar and cannula are unsatisfactory as modes of treatment, the result, derived from an examination of the fluid withdrawn from the kidney is, from a diagnostic point of view, of the highest value, and the operation is one which does not involve much danger to the patient. If the puncture be made in the situation and by the method indicated to you in a former lecture (page 147), there is little risk of doing harm so long as the kidney is adherent to the peritoneum. Of course, before performing the operation, the surgeon must make a very careful physical examination so as to ascertain the relative position of parts, and so avoid the danger of wounding any of the neighbouring viscera or blood-vessels. In all the diseases I have mentioned the characters of the fluid withdrawn are so distinctive that a clear diagnosis can readily be made when it has been examined.

When, instead of containing fluid, the kidney is occupied by a solid growth, aspiration and puncture are useless, and if the surgeon cannot ascertain the nature of the disease by a consideration of the circumstances of the case which are presented to him, by cutting down upon the kidney, either from the front or from behind, he may discover the true nature of the lesion, and treat it at once according to its requirements. Nephrotomy may therefore be performed either for diagnostic purposes, or, the nature of the malady having been previously ascertained, it may be adopted for the relief or cure of disease, while under the circumstances first mentioned it may be but the preliminary step to extirpation of the organ.

In the first lecture of this course (page 5) I indicated the various operations which may be resorted to for the relief or cure of so-called "surgical diseases of the kidney," and throughout this course I have, on many occasions, shown you the surgical procedure which should be adopted under different circumstances, and, from a consideration of the statistics of each, have given you the results of surgical experience. It may be profitable now to summarise these results, and, while describing the methods of operating, I will also discuss with you the advantages and disadvantages of each.

Aspiration or tapping of a fluid accumulation is likely to effect a good result only in those cases in which the secreting power of the kidney has been totally destroyed, and where complete collapse of the cyst can be brought about. Should the fluid re-accumulate, or the sac be suppurating, it must be freely incised and drained, or both the sac and the kidney may be excised together.

In respect to treatment by tapping nothing more requires to be said, as I have fully discussed the indications for that operation when we had the treatment of hydronephrosis, cystic disease, and hydatids of the kidney under consideration. We may therefore now pass on to an account of the more serious renal operations—namely, nephrotomy, nephrolithotomy, nephrectomy, and nephrorraphy.

Nephrotomy, or simple incision into the renal substance, is an operation performed for various lesions of the kidney, amongst which may be mentioned hydronephrosis, cystic degeneration, hydatids, tubercular and other suppurative diseases, traumatic lesions, and urinary fistulæ. It is an operation which has been resorted to since early times, but in a different way, and with different purposes in view from those entertained by the modern surgeon. While the earlier operators were satisfied that they were doing all that was required of them, when they opened abscesses of renal origin pointing in the groin—that is to say, anticipated nature by a few days or weeks, and after the kidney had been destroyed—the surgeon of the present day attempts and succeeds in doing something more. He aims not only at saving the life of his patient, but also at preserving from destruction the secreting tissue of the affected organ. Although this may not always be attainable, it should at least be attempted by operating as early as it is possible to form a reliable diagnosis. Look, for instance, at the history of ovariotomy; does it not convince the least observant surgeon that in many of the earliest, and in not a few of the later cases, the want of success was, and still is, due to delay and indecision on the part of the professional attendant? When your choice is between an operation and inevitable death, why wait, if you desire the dangers to the life of the patient to be reduced as far as possible? Early operation and successful treatment go hand in hand. Performed in the early stage of disease, and with all the improved surgical methods of the present day, nephrotomy is an operation attended with little risk.

For the operation of nephrotomy there is practically little choice in regard to the situation of the incision, it being made, unless under exceptional circumstances, at the same spot in all cases. The bowels having been emptied by a laxative and an enema, the patient is made to lie upon his healthy side, a thick, firm pillow being placed under the flank, so that when the patient rests upon it the diseased side is made to arch upwards, and to be prominent. The incision should be the same as that adopted for lumbar colotomy (Amussat's operation), in which the colon is opened from behind without wounding the peritoneum. From a point situated in the centre of the crest of the ilium to the free extremity of the last rib a line is drawn, and at right angles to the centre of this line an incision is made from the outer border of the erector spinæ muscles, forward for a distance of three or three and a half inches, according to the size of the abscess, sac or cyst. The skin, fascia, &c., being divided, the latissimus dorsi and the edge of the external oblique muscles are seen, and should be divided in the same line as the incision through the more superficial tissues. These structures having been cut through, the internal oblique muscle of the abdomen and the fascia lumborum are exposed, and must be carefully divided on a director, when the adipose capsule of the kidney is brought into view. All hæmorrhage, which is usually but slight, having been controlled either by clip-forceps or by ligature, the lips of the wound should be held apart by thin broad retractors. In most instances the kidney will now be found to have formed more or less firm adhesions to the surrounding organs and tissues, or if the inflammatory process be an acute one, suppurative changes may have been induced in neighbouring parts. The kidney having been exposed, a careful endeavour should be made to ascertain its precise condition previous to opening it, and this examination may be made by systematic palpation, and, if necessary, by acupuncture, which must be employed without fear if the subjective symptoms warrant the suspicion of a renal calculus. This search having been concluded, and no calculus found, the kidney should be incised from above downwards with a narrow-bladed knife, and the wound thus made may be enlarged by inserting into it a pair of closed dressing forceps, then by separating the blades and withdrawing the forceps, the contents of the hydronephrosis, pyonephrosis, cyst, or abscess are readily evacuated.

When the cortex is cut into, sharp, but not prolonged, hæmorrhage occurs, and can usually be easily controlled by pressure. By making the incision in the line of the vessels and uriniferous tubules, few arteries of any size are divided, and the smaller arterioles, which bleed profusely to begin with, soon contract and become closed. In cases where a calculus is not situated in the renal pelvis, the incision is usually made into the substance of the organ, because the pelvis is more difficult to reach and drain, and as far as is known, little harm results from an incision into the renal parenchyma. When the kidney is not greatly altered in appearance, the operation of nephrotomy is easily performed, but in not a few instances, the structural changes in and around the organ are so great that it is with the utmost difficulty that the surgeon can assure himself of the relationships of parts. Under such circumstances, the incision must be made into the most prominent part of the kidney, and the cavity freely drained. In some cases of hydronephrosis, pyonephrosis, or hydatid disease, it may be advisable not only to open the sac, but also to stitch its cut edges to the lips of the wound in the parietes, in order to reduce the danger of the surrounding tissues becoming infiltrated by urine or the contents of the sac. Two lines of sutures should be applied, the one deep, the other superficial, and the parts should be as accurately adjusted as possible. The sac and the wound having been thoroughly washed out with a strong antiseptic solution, a large sized drainage tube should be introduced and retained at the most dependent part of the wound. The length of time during which the tube must be kept in depends upon the individual case. To this, and some other points, I shall return presently; in the meantime, I desire to call your attention to the results of nephrotomy in different diseases.

The conditions of the kidney which call for this operation are hydronephrosis, cystic disease, tubercular and non-tubercular suppurative disease, traumatic lesions, and fistulæ. By an examination of statistics, it will be easily seen that the ultimate results of surgical interference rest upon the lesion for which the operation is performed; thus, in cases of hydronephrosis and cystic disease without suppuration, of 21 cases operated on all recovered, whereas, in other cases in which the kidney was occupied by a purulent accumulation, out of 49 operations 13 were unsuccessful; and for tubercular disease active treatment is even more unsatisfactory, as will be seen from this table.

TABLE SHOWING THE LESIONS FOR WHICH NEPHROTOMY HAS BEEN PERFORMED, AND THE RESULTS OF THE LUMBAR AND ABDOMINAL OPERATIONS.

	ABDOMINAL.		LUMBAR.		TOTAL.	
	Recovery.	Death.	Recovery.	Death.	Recovery.	Death.
Hydronephrosis, . .	3	...	12	...	15	...
Cystic Degeneration, .	4	...	2	...	6	...
Suppurative Disease without Calculus,	1	2	35	11	36	13
Tubercular Disease, .	1	...	13	6	14	6
Traumatic Lesions, .	...	...	5	...	5	...
	9	2	67	17	76	19

When nephrotomy is performed for hydronephrosis or cystic disease, the parenchyma of the kidney having been previously destroyed by the lesion, the sac may contract and a cure may be ultimately effected without further operative interference; but when the renal tissue has not been completely destroyed by disease, a permanent fistula may become established in the loin; or should the kidney be the seat of profuse suppuration, the offensive nature of the discharge may not only render life intolerable to the unfortunate sufferer, but through time it may act so injuriously as ultimately to cause death from amyloid disease or exhaustion. To prevent this nephrectomy may be required.

When the kidney or its pelvis is occupied by a calculus, it may be necessary to cut down upon and into the organ and remove the calculus; in other words, to perform nephro-lithotomy. This operation may be demanded under two very different circumstances—first, when the foreign body has, by its presence, induced suppuration in the kidney or its pelvis; and, second, in those cases where, with the recent improvements in diagnosis, the surgeon is able to detect the presence of a stone before pus accumulates in the kidney, or appears in the urine. The removal of renal stones in cases of calculous pyelitis is not an operation limited to modern times, but it is to be observed that, when the older surgeons ventured to incise the kidney, it was only when a distinct swelling appeared in the loin, and nature showed the way. To Mr. Thomas Smith is due the credit of first seriously suggesting the operation of cutting down upon the kidney for the removal of a calculus, in a paper read before the Royal Medical and Chirurgical Society of London in 1869; and the earliest operation in which a calculus was designedly removed from a suppurating kidney was performed in April, 1872, and published by Andrew and Callender in *St. Bartholomew's Hospital Reports*, vol. ix. But if you glance over the statistics of nephro-lithotomies for calculus with suppurative disease of the kidney, you will at once be convinced of the serious nature of the disease, and the inability of the surgeon to cure the malady in many cases.

Not only is the kidney more or less disorganised in these cases before the operation is performed, but the general health of the patient is so much impaired, that not infrequently death supervenes within a few hours or days, from shock, collapse, and exhaustion.

The mortality in nephro-lithotomy for calculus with suppuration (taking all cases), as shown to you in a former lecture, is 43·3 per cent. The aim of the surgeon in these cases was not only to extract the calculus, but also to give exit to pus. In nephro-lithotomy for calculus without suppuration the principle acted upon is entirely different. The object is to extract the stone, and preserve the kidney from the destructive changes which are almost certain to supervene if the foreign body is not removed.

To the signs and symptoms of renal calculus warranting an exploration of the kidney, I have already called your attention fully (page 252). When these are present it is necessary, without hesitation, to explore the kidney. The extraction of a stone from the kidney before the organ has become so altered as to give evidence of suppurative changes having taken place, is a principle first definitely laid down by Mr. Morris in 1880; and, in view of the very satisfactory results revealed by statistics, must be looked upon as a valuable achievement of modern surgery. But while we cannot do otherwise than rejoice at the success of renal surgery in this particular field, we must not permit the dangers attendant upon rash operative interference to escape our notice, and should bear in mind the following remarks made by Dr. Dickinson in regard to renal lithotomy. He says, in his work published in 1885, "The feasibility of this operation is so important a question that I shall briefly review the existing experience of it as far as it has come to my knowledge; it is probable that, as a record of fruitless attempts and fatal performances, the list may be incomplete, but it is to be presumed that no successful extraction of a stone from the kidney has escaped notice."

I have quoted these remarks to you not because they are entirely true, but because they contain an element of truth, and represent the opinion of a cautious but conservative physician—conservative in the sense of being opposed to rapid change in practice, but not in the sense that it should be the endeavour of practitioners of the healing art to save from disorganisation an important organ, by removing as early as possible a foreign body, which is sooner or later almost certain to produce destructive changes.

Dr. Dickinson, after giving a history of the operation, tabulates the cases recorded between 1870 and 1882 under the following heads:—

1. Cases of renal lithotomy performed or attempted, in which a stone was found, 14 cases.

2. Cases of attempted renal lithotomy, in which no stone was found, 8 cases.

3. Removal of kidney for stone, either as a sequel to lithotomy or independently, stone present, 9 cases.

4. Removal of kidney for stone, either as a sequel to attempted lithotomy, or independently. No stone present; 7 cases.

(Three cases are included in two tables, so that, out of 35 persons operated on for stone in the kidney, a calculus was found to be present in 22, whereas in 13 no stone was discovered).

But while pointing out the large proportion of cases in which no stone was found, Dr. Dickinson expresses the belief that the proportion of erroneous diagnosis will diminish now that attention is called to the subject, and goes on to say—

"It can scarcely be accepted as a persistent rule that in a third of the instances in which a renal stone is confidently diagnosed, no such concretion exists. Did the difficulty of diagnosis amount to this, the feasibility of any operation for its removal with or without the kidney would scarcely need further discussion. But, as in many novel enterprises, the early adventurers fell into errors, which may serve as warnings against their repetition. The incision into and the removal of the healthy kidney presents itself in this light. With such facts before us as the tables present, we may at least insist that no operation for the relief of renal calculus be undertaken on the evidence of pain or general symptoms, unless corroborated by the discharge of blood or pus, or at least, as in Mr. Butlin's case, of crystals and albumen."

This opinion is to some extent at variance with what I expressed to you a short time ago, and it is based upon a somewhat erroneous view of facts. Dr. Dickinson classes all cases of renal calculus together, whether they happen to be associated with suppuration of the kidney or not. The point of distinction in his mind is not the one I have made, but it is whether or not a stone has been discovered; and when he finds that in a considerable number of all cases no calculus was found, he gives expression to the opinion

I have just quoted. In other words he advises the postponement of the operation until those changes have been produced in the kidney which, as I have shown you by statistics, cause the high mortality in nephro-lithotomy for pyelitis and pyonephrosis due to calculus. The presence of blood and crystals in the urine is a most valuable aid in assisting one in forming a diagnosis, and, unless the subjective phenomena are characteristic, is necessary to a reliable diagnosis. But if these constituents are present in the urine why wait until suppuration has been established and revealed by the presence of pyuria?

Lumbar nephro-lithotomy is an operation not difficult to perform. The incision through the abdominal walls is practically the same as in lumbar nephrotomy, with the exception that in some cases the incision may require to be extended a little further towards the spine, in order to allow the operator to manipulate the kidney more freely. When the incision has been made through the soft parts, all the bleeding vessels having been secured, the edges of the wound should be drawn well apart, so as to expose the adipose capsule of the kidney, which is sometimes of considerable thickness. The perirenal fat is generally loose externally, and gradually, as it approaches the kidney, becomes denser in consistence, and of a slightly darker yellow hue.

One point must be borne in mind, namely, that the position of the kidney is not constant; even in health it varies in position greatly. For example, in one case the kidney may be close up to the diaphragm, almost touching the diaphragm and vertebral column; while in another the organ may be situated low down and removed some distance from the spine. When in the former position some difficulty may be experienced in reaching the kidney, especially if it is not enlarged or distended. But if the calculus has caused inflammatory changes in the substance of the organ, not only may it become enlarged, but considerable change may be induced in the tissues around, so that they are no longer recognisable, being converted into soft pulpy material, or dense and tough connective tissue, according to the phase or course of the case. When the kidney has been exposed, the first duty of the surgeon is to examine it carefully and systematically by palpation, and should any part of the kidney or pelvis offer undue resistance to the hand, such as to suggest the locality of the calculus, this evidence must be further tested by puncturing the organ with a fine round needle. This method of exploration must be carried through systematically and freely, there being little reason to believe that the renal parenchyma suffers much from this mode of examination. The substance of the kidney having been carefully searched, and no calculus found, the pelvis should next be punctured, and a curved probe, as suggested by Mr. Bruce Clarke, should be passed, and the entire cavity of the kidney explored.

A calculus of considerable size may exist in the kidney without being detected, even by a most careful and skilled examination. Morris mentions a case in which he removed "a healthy kidney for a calculus, the size of a marble embedded in it, but which I could not localise. Even after the removal of the kidney, the locality of the stone could not be made out by pressing the organ between the finger and thumb; nor by pressing upon the kidney as it lay upon the table;" and in connection with this case he remarks: "The kidney becomes very hard and tough under the prolonged irritation of a stone, so that whilst the whole organ feels firmer than natural, any slight difference in the degree of resistance of one part is all the more difficult to appreciate. This hardness of the renal substance should make the surgeon very suspicious of a calculus, and future experience will, I think, encourage him, when this condition is present, not to be satisfied either that no stone exists, or that nephrectomy must be performed, until he has made such an incision into the kidney as will open each of the calices. Kidney wounds are known to heal readily, and whilst the risk of such an incision would not equal that of nephrectomy, the subsequent condition of the kidney would be preferable to the possession of only one organ."

If a calculus be detected by the hand, the needle, or the pelvic probe, the operator must next consider what is the best way to remove it, and he has the choice of incising the renal parenchyma or the wall of the pelvis. If the calculus is lying close to the capsule of the kidney, it is clear that the easiest and safest method of reaching the stone is by cutting through the tissue covering it, and this should be done by a straight incision with a narrow knife to begin with, and the opening may be enlarged by dilating with dressing forceps, by which the stone may be seized and extracted. When, however, the stone is situated in the pelvis or one of the calices, the question arises should the wall of the pelvis or the renal tissue be incised. In respect to this point there is a difference of opinion, some surgeons advocating one method, while others with equal enthusiasm support the other mode of operating. But, as far as I can ascertain, while the two methods are equally satisfactory in respect to the immediate result, in those cases in which the incision has been made through the parenchyma, the wounds have healed more easily, and permanent urinary fistulæ have been less common. Stones of large size have been removed by incision into the pelvis, the largest being over two ounces in weight, while by dividing the renal tissue either by the knife, dressing forceps, or thermo-cautery, calculi of equal size and weight have been extracted. The bulk of the stone cannot therefore be taken as a guide. When the stone is large it may be broken with a lithotrite, or with strong forceps, and the fragments and *debris* removed subsequently.

Abdominal nephro-lithotomy has recently been suggested by Mr. Knowsley Thornton, who recommends an abdominal incision for the purpose of exploration, and, if a stone be found, a second incision to be made in the loin for its extraction. In 1883 Mr. Thornton practised the method here suggested; the abdominal incision admitted the left hand of the operator, who, having examined the kidneys, found a calculus in the right one. The left hand was further used to fix the stone in the pelvis of the kidney, while with a knife in the right hand a clean incision was made in the loin straight down on the stone. The arguments brought forward in favour of Thornton's operation are—(1) That in operating by the lumbar incision alone, not only is an exact diagnosis difficult, but a stone may exist in the kidney without being detected, or the surgeon may even fail in reaching the kidney; whereas, by the combined operation, we should "never fail to find the kidney, never cut into a healthy kidney, and leave the one with the stone; never damage the peritoneum, by a puncture, without knowing it, and we could examine the other kidney and both ureters." "The stone would be removed through a small clean cut in the loin, which was far preferable to the method of dissection, since this latter allowed of infiltration of the tissues, and favoured the chances of severe inflammation and septicity; and, finally, the combined method allowed of a thorough examination of the kidney, so that a decision could be come to which was the best operation—nephrotomy or nephrectomy—for the individual case." In opposition to these arguments of Mr. Thornton's in favour of the combined operation, it has been pointed out by Mr. Godlee "that while a number of stones might be cleared out of a kidney which were causing no symptoms, a small one might escape the detection even of the experienced in the opposite kidney, which after all had been the cause of the colic." This argument seems to me to apply just as much to the lumbar operation alone as to the combined one, but I admit the force of Mr. Godlee's words, when he further proceeds to say, "It is surely possible that, if a stone can escape detection through a lumbar incision, when the organ can be felt above and below, and behind as well as in front, it might fail to be detected when the finger can only reach the anterior aspect." Further, I may remind you that in many cases the amount of adipose tissue around the kidney is so considerable that, unless the stone was of considerable size, it would be impossible to detect it without cutting through the peritoneum, and removing the adipose capsule from the surface of the kidney. Mr. Thornton's contention that, by the combined method, it is impossible to overlook the presence of a renal calculus, does not hold good in all cases. For example, in Morris' case (page 430), that surgeon was unable to detect a calculus in a kidney even after it was removed from the body, and it was only by an incision of the organ that the stone was discovered.

In a former lecture (page 269) I made a comparison between nephrotomies and nephro-lithotomies for suppurative disease, and showed you that operations for suppurative disease arising from renal calculus have a higher mortality throughout than when performed for suppurative lesions of the kidney from other causes. The mortality in nephro-lithotomies in suppurative disease with calculus, is, abdominal operations, 83 per cent, and lumbar operations, 39·6 per cent. To contrast with these unfavourable results we have the very satisfactory fact shown by my statistics, that, out of 42 cases operated upon for calculus without suppuration, there is not a single death (pages 255 and 258). This circumstance is of the utmost importance, and demonstrates most clearly that the early diagnosis and the prompt treatment of renal calculus by nephro-lithotomy mean success, whereas delay in forming a clear opinion of the nature of the case, and acting upon it, not only entails much suffering to the unfortunate patient, but involves enormously greater risk to life, should an operation be demanded after serious structural changes have taken place in the kidney.

In those cases in which a calculus is removed from an otherwise healthy organ comparatively little local after-treatment is required. The main point to attend to is to have free drainage. The urine from the wounded kidney does not flow through the natural passages for some time; hence, by removing the discharges as soon as possible, we endeavour to keep the wound free from products of decomposition. From the nature of the case it is not possible to keep the wound strictly aseptic, but it can at least be kept thoroughly clean. Probably the best mode of dressing is to have a large drainage tube extending from the depths of the wound to 2½ or 3 inches beyond the surface. A dressing of sublimated absorbent cotton-wool (Gamgee's tissue), covered externally by a sheet of gutta-percha tissue, should be placed over the wound, and through a hole in the dressing the drainage tube should be passed. With a little chloroform the margins of the gutta-percha tissue (which should be larger by half an inch all round than the Gamgee dressing) should be cemented to the skin, and to the sides of the drainage tube, so that the discharges from the tube do not soil the dressing next to the wound. Over the first a second absorbent dressing should then be applied, for the purpose of absorbing the discharges from the drainage tube. This second dressing requires to be changed frequently, in order to keep the bed clothing dry, but if the drainage tube is acting properly, the first dressing may not need to be removed oftener than once a day.

In the cases of which I am at present speaking, the wound in the kidney should be allowed to heal before that of the soft parts. The repair of the renal tissue usually takes place rapidly, and the urine and any discharge there may be from the substance of the organ escape down the ureter. In comparatively few cases fistulæ remain.

In nephro-lithotomy for suppurative disease the local after-treatment is very much the same as I have indicated to you just now, but, instead of the wound healing within a few days or weeks, a urinary fistula is liable to be established. In favourable cases nephro-lithotomy and free drainage are followed by a shrinking and closure of the suppurating sac; and even although a fistulous opening may remain, the patient being relieved of continuous and acute suffering is in a better position than he occupied previous to the operation. When, however, the discharge is copious, and as time passes not perceptibly diminishing, nephrectomy may be demanded, and if to be performed, should be undertaken early and before the patient loses strength.

Nephrectomy is an operation which has been resorted to in a large number of instances, being called for in many diverse lesions such as movable kidney (page 62), hydronephrosis (page 158), cystic disease (page 158), suppurative disease with calculus (page 272), and without it (page 237), tubercular disease (page 340), traumatic lesions (page 343), and benign and malignant tumours (page 450).

Previous to Simon's operation, which was the first one performed on a definite physiological principle, the kidney was removed from the living body by Peaslee, Esmarch, Speigelberg, and Walcott, but in all these cases the operation was undertaken in the belief that the disease was ovarian, with the exception of the last mentioned, which was thought to be a cyst of the liver. Hence, although nephrectomies were performed before 1869, it is only since that date that extirpation of the kidney has been resorted to as a method of treating disease known to be of renal origin. In this country as in others, most of the earlier operations were performed on an erroneous diagnosis; thus Meadows, Campbell, and Heath, before 1877, removed kidneys in the belief that they were dealing with ovarian cysts. Mr. Jessop, of Leeds, was, I believe the first British surgeon who practised nephrectomy on the lines laid down by Simon. In the first volume of the *Lancet* for 1877 he published an account of a case of encephaloid cancer of the kidney in which the organ, weighing 16 ounces, was removed successfully by lumbar nephrectomy. The diagnosis was correctly made previously to the operation. Since that time many nephrectomies have been performed in this country and abroad.

Before discussing the various methods of operation I desire to ask your attention to this table which shows the diseases for which nephrectomy has been performed and the results of lumbar, abdominal, and combined operations.

NEPHRECTOMIES.

Disease.	Abdominal.		Lumbar.		Combined.		Total.		Percentage of Deaths.
	Recoveries.	Deaths.	Recoveries.	Deaths.	Recoveries.	Deaths.	Recoveries.	Deaths.	
Movable Kidney, ...	15	9	6	—	—	—	21	9	30·0 %
Hydronephrosis, ...	9	9	8	3	1	—	18	12	40 0 %
Cystic Disease, ...	8	6	2	—	—	—	10	6	37·5 %
Suppurative Disease without Calculus,	4	6	32	12	—	—	36	18	33·3 %
Suppurative Disease with Calculus, .	8	6	28	16	3	—	39	22	36·0 %
Tubercular Disease, ...	5	2	16	10	—	—	21	12	36·6 %
Traumatic Lesions, ...	1	—	18	8	—	—	19	8	33·0 %
Tumours. Benign, ...	8	3	1	—	—	—	9	3	25·0 %
Tumours. Carcinomata,*	3	11	7	2	—	—	11	14	56·0 %
Tumours. Sarcomata,†	11	14	5	3	—	—	17	19	53·0 %
	72	66	123	54	4	—	201	123	35·2 %

* Nature of operation not stated in Carcinoma 2 cases—(1 death, 1 recovery).

† Nature of operation not stated in Sarcoma 3 cases—(2 deaths, 1 recovery).

Taking a general review of these results it is to be observed that the mortality of the operation of nephrectomy taken all over is 35·2 per cent, and that, as a general rule, this average is exceeded in those diseases which are in themselves grave, and not reached in the less serious maladies. Hence we find that the mortality in excision for movable kidney, benign tumours, traumatic lesions, and suppurative disease without calculus is below the mean; further, operations for such conditions as suppurative disease with calculus, tubercular disease, cystic degeneration, and hydronephrosis, are distinctly over the average, while in diseases of an even more serious nature, such as the malignant tumours, the mortality exceeds 50 per cent.

The diseases for which nephrectomy has been performed are so various that it is almost impossible to contrast the relative values of the lumbar and abdominal operations, and this difficulty is increased by the circumstance that in many of the abdominal excisions the operation has been undertaken on an erroneous diagnosis. Taking, however, the facts as they appear in the table, it may be stated that the mortality in the lumbar nephrectomies is 30·5 per cent, and in the abdominal 47·1 per cent. This unfavourable result in the abdominal operations, although general throughout, is largely increased by the number of cases in which it has been resorted to for the treatment of malignant neoplasms, as well as for the more serious varieties of other lesions. Seeing therefore that abdominal nephrectomy has been employed to a larger extent than the lumbar operation for the graver renal diseases, it is incorrect to contrast the two operations as if they had been used alike, and to commend the one and condemn the other indiscriminately. I think indeed I am safe in saying that, if the relative position of the two operations were reversed, the mortality in the lumbar operation would be much higher than that of the abdominal one now is.

I shall presently have to state to you the arguments for and against the various operations, but at present I desire to urge upon you my conviction of the worthlessness of general statistics, as bearing upon the merits of these several modes of procedure, when considered irrespective of the peculiar circumstances under which they are individually employed. It is only by a careful study of the details of a large number of cases that one can determine the conditions which are favourable to the adoption of one operation in preference to another. It has been too often the case, in this as in other departments of surgery, that when one has performed a certain operation successfully a few times, he extols his own mode of manipulation, and condemns those of others without due regard to the wider consideration of the subject.

We may now glance at the arguments for and against the three methods of performing nephrectomy—namely, the median and lateral abdominal, and the lumbar.

The first mentioned has been largely employed in the treatment of such conditions as hydronephrosis, cystic disease, and neoplasm—lesions in which considerable space is required for manipulation. In so far as it widens the field of operation, and gives the operator free access not only for the removal of the diseased parts and for the controlling of hæmorrhage, but also for the purpose of ascertaining, as far as it is possible by palpation, the condition of the other kidney, this operation is to be commended. But while these advantages cannot be denied, it has been urged against both of the abdominal operations, but especially the median, that not only is the peritoneum wounded, but the meso-colon must be divided before the kidney is reached. Besides, as a consequence of the situation of the wounds, and the circumstance that the peritoneal cavity has been opened, it is found to be difficult to drain away the blood and discharges without contaminating the abdomen, and thereby increasing the danger of death from peritonitis. Another, but what seems to me to be a very paltry drawback to the abdominal operations, is the supposed liability to ventral hernia at the site of the incision in the tight muscular abdominal wall. Taking all cases of abdominal sections, in how many has ventral hernia been induced? I have only seen two, and as far as I can ascertain, very few have been published, notwithstanding the large number of abdominal sections that are being yearly performed. The two most serious objections to the abdominal operations are, the trouble occasioned during the operation by the intestine protruding through the wound, and the difficulty in procuring efficient drainage after the operation.

The advantage claimed for the lateral abdominal (Langenbuch's) incision, as compared with the median abdominal, is that by careful manipulation, even although the peritoneum is opened during the first stage of the operation, by subsequently suturing the meso-colon to the margin of the anterior lip of the parietal incision, the kidney can be removed without danger of the cavity of the abdomen being contaminated.

Another reason why this operation should be selected is, that on account of the situation of the incision, at the outer border of the rectus muscle, the kidney is easily reached, and its vessels and ureter secured, while at the same time, the large veins in the anterior layer of the meso-colon are avoided. By this operation, good drainage is secured, and the wound is practically made an extra-peritoneal one.

The advantages of lumbar nephrectomy over the abdominal operation are, that unless by misadventure, the peritoneal cavity is not opened, the wound is easily and efficiently drained, and no structures are injured except those composing the parietal wall. But, on the other hand, on account of the small size of the opening in the parietes, the surgeon may experience great difficulty in reaching and removing the kidney, and, as a consequence of awkward manipulation, the vessels of the pedicle have been lacerated, and even the renal tissue ruptured.

While willingly admitting the small value of general statistics in guiding one in the choice of an operation such as we are now considering, I think it may be of interest to show you by reference to this table the causes of death in 120 fatal cases of abdominal and lumbar nephrectomy.

The table is so constructed that the causes of death in the individual diseases can be easily seen, while, at the same time, the deaths from each cause are summed up under three divisions—the first showing the deaths from abdominal nephrectomy; the second, those from lumbar nephrectomy; and the third, the combined total from these two operations. It is unnecessary to enter into the details revealed by this table, as they are easily seen. The perpendicular columns show the number of deaths in the several diseases, while the horizontal ones give the deaths from individual causes. The total deaths from abdominal nephrectomy are given in the eleventh column, those from lumbar nephrectomy in the twenty-second, and the combined total of both in the twenty-third column.

CAUSES OF DEATH IN 120 FATAL CASES OF LUMBAR AND ABDOMINAL NEPHRECTOMY.

	ABDOMINAL.										ABDOMINAL TOTAL.	LUMBAR.										LUMBAR TOTAL.	GRAND TOTAL.
	Movable Kidney.	Hydronephrosis.	Cystic Disease.	Suppurative Disease without Calculus.	Suppurative Disease with Calculus.	Tubercular Disease.	Traumatic Lesions.	TUMOURS.				Movable Kidney.	Hydronephrosis.	Cystic Disease.	Suppurative Disease without Calculus.	Suppurative Disease with Calculus.	Tubercular Disease.	Traumatic Lesions.	TUMOURS.				
								Benign.	Carcinoma.	Sarcoma.									Benign.	Carcinoma.	Sarcoma.		
Shock and Collapse, .	1	3	2	3	1	1	...	1	4	4	20	...	1	...	6	4	4	5	...	...	1	21	41
Uræmia & Suppression of Urine, . .	4	...	1	1	...	1	...	...	2	..	9	...	1	...	2	3	1	...	...	...	...	7	16
Peritonitis, . . .	2	2	2	...	1	...	...	2	4	5	18	...	...	...	1	...	...	1	...	...	...	2	20
Pyæmia and Septicæmia,	1	1	...	...	...	...	...	...	...	...	2	...	...	...	1	4	1	...	...	...	1	7	9
Hæmorrhage, . .	...	1	...	...	2	...	...	...	...	2	5	...	...	...	...	1	1	...	...	...	...	2	7
Œdema of Lungs, . .	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	1	2
Œdema Glottidis, . .	1	...	..	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Pulmonary Thrombosis,	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Phthisis Pulmonalis, .	..	...	. .	...	...	...	...	...	...	...	...	...	...	..	...	1	...	...	...	...	...	1	1
Cancer, . . .	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	1
Recurrence of Tumour, .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1
Strangulation of Bowel,	...	...	...	..	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	1
Suppurative Pyelitis, .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	1
Tetanus, . . .	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1
Vomiting, . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	1
Acute Mania, . .	...	1	...	1	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	2
Cause of Death not stated,	...	1	...	1	2	...	..	...	...	2	6	...	1	...	2	2	2	1	...	...	...	8	14
	9	9	6	6	6	2	...	3	11	14	66	...	3	...	12	16	10	8	...	2	3	54	120

The most pronounced fact shown by this table (page 442), is that almost exactly a third of the deaths from nephrectomy have been occasioned by shock or collapse. When taken in relationship to the operations performed, it will be seen that the mortality from this cause is respectively—abdominal, 14·5 per cent; lumbar, 12 per cent; so that as far as death from shock is concerned the two operations are about equal. Taking, however, the next most frequent causes of death, namely, peritonitis, septic poisoning, and suppression of urine, a considerable difference is shown in the numbers, which, when reduced to percentages calculated on 138 abdominal and 177 lumbar operations, give the following figures:—

	Abdominal.	Lumbar.
Peritonitis, ...	13 %	1·1 %
Septic Poisoning, ...	1·5 %	4 %
Suppression of Urine, ...	6·5 %	4 %

Therefore peritonitis and suppression of urine give a higher mortality in the abdominal operations, while, on the other hand, septic poisoning accounts for 2·5 per cent more deaths in the lumbar.

Hæmorrhage, however, has caused 5 deaths in 138 abdominal operations, and only 2 deaths in 177 lumbar nephrectomies.

As in other operations so also in nephrectomy, the danger to life depends not upon the precise mode in which the kidney is removed, but upon the nature of the disease, and the stage of the malady for which excision is practised.

The combined abdominal and lumbar operation has only been performed four times, so that no conclusion can be drawn from them, but it is satisfactory to note that all these cases made a good recovery.

I shall now proceed to describe to you very shortly the technique of the three principal methods of performing the operation of nephrectomy, namely:—

1. By reaching the kidney from behind by a lumbar incision as in the operation of nephrotomy, and removing it through the wound in the loin.

2. By making an incision at the outer margin of the rectus abdominalis, on the side of the diseased kidney (Langenbuch's incision).

3. By an incision in the linea alba, as in ovariotomy.

These methods of operating are well recognised, but at the same time many surgeons have in individual cases found it necessary to modify them considerably.

Lumbar nephrectomy in its preliminary stages, that is to say, till the kidney is exposed, is in most cases the same as lumbar nephrotomy; but, on account of the small opening thus afforded, it has been found necessary on many occasions to modify the incision. Hence it has been recommended to make a vertical incision from the lowermost rib to the crest of the ilium, and if more room be required another cut is made in the parietes to join this one either at its uppermost or lowermost limits. These second incisions may be made in one of two ways—first, beginning at the upper limit of the vertical wound, by making a cut parallel to the last rib and extending it downwards and forwards; or second, the incision may be made from the lowest point of the vertical wound, and extended forwards at right angles to it and parallel to the iliac crest. In making these or other incisions, which may be suggested in the course of the operation, care must be taken not to go too near to the twelfth rib, as the diaphragm sometimes extends downwards from it, and by free incision in this direction the pleura may be injured. The kidney having been laid bare, the next step in the operation is to separate it from its surroundings, which is easy or difficult according as the surface of the kidney has or has not formed adhesions to the neighbouring parts. When the surface of the kidney is normal, the organ can with ease be separated from the tissues around it either by the finger, or by a periosteal elevator. This is frequently the case in such lesions as hydronephrosis, cystic disease, benign tumours, and renal calculus. But when the disease is of an inflammatory nature, or has led to perinephritic inflammation, the condition of matters is very different, and the difficulties of the operation are greatly enhanced by the adhesions which the indurated adipose capsule has formed with its surroundings. Consequently in such lesions as suppurative disease of the kidney, old standing renal calculus, tuberculosis, and malignant growths, the operation is a more serious one in itself, because of the intimate union which the kidney has formed with neighbouring parts. While, however, the adipose and fibrous capsules have become firmly adherent to their surroundings, the kidney itself may not be so strongly united to its capsule. Taking advantage of this circumstance it has been advised that, instead of removing the kidney and its capsules, the kidney should be exposed, the fibrous capsule divided, and the organ enucleated from it. In doing this there may in a few cases, however, be free hæmorrhage, as frequently small vessels and sometimes large ones pass from the capsule to the surface of the kidney. In one instance I observed an artery as large as the radial follow this course. This danger of hæmorrhage is not great, as when normal in size the divided vessels soon close. It is otherwise when the indurated tissue around is injured. The tissue being not only vascular, but greatly indurated, the vessels passing through it when divided gape, and show no tendency to contract. Hence the bleeding which occurs when the inflamed perinephritic tissue is cut or injured is large, sometimes even dangerous.

The kidney having been freed and the pedicle exposed, a double chromic catgut ligature should be passed, by means of an aneurism needle, through between the ureter and the vessels. The kidney is then dragged gently outwards, and the needle having been withdrawn the ligature is divided, and while one strand is made to include the vessels the other secures the ureter. Having fixed the ligatures as near the middle line as possible, the last step of the operation is proceeded with, and the organ is removed by cutting the pedicle as close to the hilus as possible with curved scissors cutting on the flat.

After the division of the pedicle a thorough search should be made in the interior of the wound, which is now easily inspected, for any bleeding points, and these having been secured a drainage tube is inserted, and the wound is washed out thoroughly with an antiseptic solution. The lips of the wound may be brought together in the ordinary way, and an antiseptic dressing applied.

Abdominal nephrectomy may be performed, as I have stated, in one of two ways; either by the lateral section at the outer margin of the rectus muscle, or by an incision in the linea alba. The former, or Langenbuch's operation, is performed in the following way:—The patient being placed upon his back, an incision is made in the linea semilunaris, on the side of the body occupied by the diseased kidney. The length of the incision in the parietes is regulated by the size of the organ to be removed. All superficial vessels having been secured, the cavity of the abdomen is opened, and, the intestine which protrudes having been pushed aside, a careful examination should be made of the diseased kidney, and its neighbour on the opposite side. Should the latter, as well as the former, be found to be seriously diseased, the operation of excision should not be proceeded with, but the abdomen should be closed without delay. But if the other kidney is presumably able to do its work, the next step of the operation is to expose the posterior layer of the meso-colon, by pushing aside the intestine. The meso-colon is then incised in a vertical direction, and an opening is made of sufficient size to admit one or two fingers behind the peritoneum. The anterior lips of both peritoneal wounds, that of the abdominal wall and that of the meso-colon, should now be united by closely set sutures of catgut, for the purpose of shutting off the cavity of the peritoneum from the space occupied by the kidney. Care must now be taken, as in the lumbar operation, in removing the kidney, so as to avoid hæmorrhage; and this is best done by the finger. When the peritoneum has been stripped off, and the kidney freed from its surroundings, the pedicle should be secured, as in the lumbar operation, and then the kidney may be enucleated, and a drainage tube introduced into the wound, so as to maintain the communication between the post-peritoneal space and the exterior.

Even although the kidney has been free from adhesions, and there is not much danger of hæmorrhage, a drainage tube should always be employed, both in this operation and the one I am about to describe; but, while in the former, the drainage tube may be brought out through the operation wound, in the latter a small opening will require to be made posteriorly for the tube to pass through.

The preliminary incisions for median abdominal nephrectomy are the same as those for ovariotomy, and require no special notice. Supposing we have gained access to the abdominal cavity by a section through the linea alba, the principal difficulty to contend with is the hæmorrhage, which is apt to occur as a consequence of incision or laceration of the large veins in the anterior layer of the meso-colon. The incision in that structure should be made in the line of the veins, and if it is found necessary to divide any of these vessels, they should be previously secured by ligatures. When the kidney has been thus safely reached, the remaining steps of the operation are the same as in Langenbuch's. In all cases a drainage tube should be introduced from behind, and, all blood clot having been removed from the space formerly occupied by the kidney, the anterior and posterior peritoneal wounds should be carefully united by fine chromic catgut suture, and subsequently the wound in the parietes should be brought together, as in ovariotomy, and dressed in the same manner.

Nephrorraphy is only employed for the treatment of movable kidney, and, as I had occasion in a former lecture to refer to the objects one should have in view in performing this operation (page 69), I shall now limit your attention to the manipulation alone.

The patient having been placed on the sound side, an incision should be made in the opposite loin, immediately external to the outer edge of the quadratus lumborum, and extending from the lowermost rib to the crest of the ilium, care being taken to avoid the diaphragm and pleura above, and the peritoneum in front, the tissues being divided down to the mass of fat surrounding the kidney, which is usually found to be freely movable behind the peritoneum. As soon as the abdominal wall is divided, an assistant should thrust his hand into the wound, and by a little manipulation succeed in pushing the kidney into the incision, and retaining it in position. Two sutures should then be passed through the adipose capsule so as to fix it. The adipose capsule should then be divided for a distance of about three and a half inches, and the convex border of the kidney be exposed. Two thick chromic catgut sutures should be passed deeply into the cortex of the kidney, so as to include its whole thickness, the needle entering the anterior surface, and passing out from the posterior aspect about half an inch from its convex margin. One suture should be passed through the upper and the other through the lower part of the organ, and the kidney be allowed to slip back into the sac formed by the adipose capsule. The edges of this capsule are now carefully stitched to the deep edges of the wound in the parietes, and the sutures (eight) cut short. Three superficial sutures may be introduced, and the sutures through the kidney passed through the muscles, fascia, and skin; the kidney should be then drawn into position, and a large drainage tube placed against the convex margin of the kidney, which now fills the bottom of the wound. These stitches are then tied, and the sutures through the kidney are secured externally by means of buttons.

NEPHRECTOMIES PERFORMED FOR TUMOURS OF THE KIDNEY.

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
1	4. vi. '61.	Walcott (Am.) *Med. and Surg. Rep.*, Phil., 1861, vol. vii.	M., 58	Ventral.	Cyst of liver.	6 years.	Cancer (encephaloid) of right kidney, 2½ lbs.; death fifteen days after operation (suppuration).	D.	—
2	viii. '68.	Peaslee (Am.) *Boston Med. and Surg. Journ.*, 24. i. '84.	F.	Median abdominal.	Ovarian growth.	—	Solid renal tumour; death five hours after operation.	D.	—
3	7. xii. '75.	Langenbuch (G.) *Berl. Klin. Woch.*, 1877, No. 34.	F., 32	Lumbar.	Sarcoma of lumbar muscles or of kidney.	18 mos.	Left kidney atrophied; no microscopic examination.	—	R.
4	20. iv. '76.	Kocher (G.) *Deutsch. Zeitschr. f. Chir.*, ix, s. 312.	F., 35	Ventral.	Sarcoma with movable kidney.	18 mos.	Extensive sarcoma; death in three days from peritonitis.	D.	—
5	4. vii. '76.	Hueter (G.) *Deutsch. Zeitschr. f. Chir.*, ix, 527.	F., 4	Linea alba.	Splenic or ovarian growth.	1 year.	Sarcoma of right kidney, weighed 5 lbs.; death during operation from hæmorrhage.	D.	—
6	7. i. '77.	Jessop (Leeds). *Lancet*, i, 1877, p. 889.	M., 2½	Lumbar.	Renal cancer.	1 year.	Encephaloid of left kidney, 16 oz.; recovery, followed 9 months after by recurrence.	—	R.
7	27. ix. '77.	Kocher (Bern). *l.c.*, p. 312.	M., 2½	Ventral.	Renal tumour.	2½ years.	Adenosarcoma (3 lbs.) of the left kidney; hæmorrhage considerable; death on second day from peritonitis; hypertrophy of right kidney.	D.	—
8	14. iii. '78.	Byford (Am.) *Tr. Amer. Gynæ. Soc.*, 1880, p. 71.	F., 39	Linea alba.	Encephaloid of right kidney.	18 mos.	Tumour weighed 4½ lbs.; patient well, July, 1880.	—	R.

9	9. xii. '78.	Martin (Berlin). *Berl. Klin. Woch.*, 1879, No. 23.	F., 53	Ventral.	Sarcoma of kidney.	2 mos.	Alveolar-carcinoma of right kidney; recovery, and out of bed in seventeen days.	—	R.
10	19. i. '79.	Czerny (Heidelberg). *Centralb. f. Chir.*, 1879, No. 45.	M., 50	Do.	Malignant tumour of kidney.	2 years.	Medullary sarcoma; profuse hæmorrhage at operation; aorta ligatured; death in ten hours.	D.	—
11	1. iv. '79.	Billroth. *Weiner Med. Woch.*, xxviii, 1880.	F., 35	Abdominal.	Fibroma adherent to the left kidney.	—	Fibro-myoma; death from peritonitis; tumour retro-peritoneal.	D.	—
12	11. viii. '79.	Lossen (Heidelberg). *Deutsch. Zeitschr. f. Chir.*, xiii, s. 199.	F., 37	Linea alba.	Tumour of right ovary.	1 year.	Angio-sarcoma six times the size of kidney; severe hæmorrhage during operation; well, July, 1881.	—	R.
13	23. xi. '79.	Bardenheuer (Cöln). (Private.)	F., 22	Lumbar.	Sarcoma of kidney or perinephritis from stone.	5 mos.	Small spindle-celled sarcoma of right kidney; died on 3rd Dec. from sepsis.	D.	—
14	23. xii. '79.	Barker (London). *Tr. Med. Chir. Soc.*, lxiii, p. 181.	F., 21	Linea alba.	Cancer of right kidney.	8 mos.	Encephaloid cancer (30½ oz.); death in forty-eight hours from pulmonary thrombosis.	D.	—
15	10. iii. '80.	Czerny. *Archiv. f. Klin. Chir.*, xxv, p. 860.	M., 30	Lumbar.	Hydronephrosis of left kidney; phthisis.	Congenital.	Round-celled sarcoma, with hydronephrosis and tubercular disease of liver, lungs, spleen, and kidney; death in half an hour from shock.	D.	—
16	2. viii. '80.	Czerny. *Braun. de Med. Woch.*, 1881, No. 31, p. 422.	F., 11 mos.	Abdominal median.	Tumour of kidney.	6 weeks.	Large adenoma; death 2½ days after from peritonitis.	D.	—
17	23. iv. '81.	Czerny. *Ibid.*	M., 51	Lumbar.	Tumour of left kidney.	1 year.	Large angio-sarcoma; recovered from operation, but died in 1881 from recurrence.	—	R.
18	25. vii. '81.	Czerny. *Trans. Int. Med. Cong. Lond.*, ii, 261.	M., 46	Do.	Sarcoma of left kidney.	6 mos.	Large sarcoma of lower portion of kidney; death in twelve days from tetanus.	D.	—

NEPHRECTOMIES PERFORMED FOR TUMOURS OF THE KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Recovery.
19	1. viii. '81.	Lücke (Strasburg). *Deutsch. Zeitschr. f. Chir.*, xv, s. 518.	M., 60	Abdominal.	Sarcoma of right kidney.	?	Primary cancer of right kidney, 21 × 11 × 9 cm.; death on fourth day from uræmia.	D.	—
20	5. ix. '81.	Whitehead (Manchester). *Brit. Med. Jour.*, 1881, ii, p. 741.	M., 46	Linea alba.	Sarcoma of right kidney.	6 mos.	Death on fourth day; left kidney healthy; autopsy failed to show cause of death.	D.	—
21	10. ix. '81.	Hicquet (Lüttich). *Bull. Acad. Med. Belgique*, '82.	F., 6	Abdominal.	Sarcoma of left kidney.	1½ yrs.	Large sarcoma of left kidney; healed in two weeks; well, 24. i. '82.	—	R.
22	25. ix. '81.	G. Thomas (New York). *Med. News*, 1882, i, p. 9.	F., 21	Do.	Ovarian tumour.	?	Fibroma of capsule; 10½ lbs.: well in four weeks.	—	R.
23	1881.	Esmarch (Berlin). *Centralb. f. Chir.*, 1882, p. 72.	—	—	Carcinoma of kidney.	—	Carcinoma of kidney; died in 8 days from intestinal perforation.	D.	—
24	10. iii. '82.	Adams (London). *Med. Times and Gaz.*, 1882, ii, p. 678.	M., 39	Lumbar.	Sarcoma of kidney, hæmaturia, 2 years.	2 yrs.	Medullary carcinoma of left kidney; organ twice normal size; numerous secondary deposits; pleurisy; death 44 days from recurrence.	D.	—
25	8. v. '82.	Tait (Birmingham). *Brit. Med. Jour.*, 11. xi. '82.	F., 24	Do.	Pus in urine, tumour in right Kidney.	—	Nature of tumour not stated.	—	R.
26	3. v. '82.	Bardenheuer (Cöln), (Private Communication).	F., 51	Abdominal.	Tumour.	—	Large fibroma of kidney.	—	R.

27	1882.	Ollier (Lyon). *Acad. d. Méd.*, Sept., 1883.	Child, 4	Abdominal.	Sarcoma of kidney.	?	Sarcoma of kidney; death from shock one hour after operation.	D.	—
28	1882.	Réczey (Pest). *Centralb. f. Chir.*, 1883, No. 31.	M., 5½	Do.	Primary carcinoma of kidney.	?	Medullary carcinoma (8 lbs.); death in three days from septic peritonitis.	D.	—
29	1. vii. '82.	Bruntzel (Breslau). *Berl. Klin. Woch.*, 1882, No. 49, p. 744.	F., 33	Linea alba.	Tumour of kidney.	5 yrs.	Fibroma of capsule (37½ lbs.); recovery.	—	R.
30	12. vii. '82.	Heath (London). *Brit. Med. Jour.*, 1882, ii, p. 100.	Child	—	Sarcoma of kidney.	—	Sarcoma; died ten hours after operation from collapse.	D.	—
31	2. ix. '82.	Rawdon. *Liverpool Med. Chir. Jour.*, 2nd Sept., 82.	F., 16 mos.	Linea alba.	Tumour of left kidney.	2 mos.	Large round-celled sarcoma of left kidney; interior contained several cysts; weight 14 oz.; death from collapse fifteen hours after operation.	D.	—
32	13. xii. '82.	Wells (London). *Med. Chir. Trans.*, 1883, p. 305.	M., 58	Abdominal.	Carcinoma of kidney.	1½ years.	Carcinoma of kidney; 6 × 4 inches; death in five days from collapse.	D.	—
33	18. xii. '82.	Czerny. *Loc. cit.*	F., 38	Lumbar.	Cystic kidney, malignant.	3 years.	Medullary carcinoma, with cystic degeneration; died on twenty-fifth day from œdema of lungs.	D.	—
34	1882.	Bókai. *Orvosi hétilap.*, vii, '83.	M., 5	Abdominal.	Primary sarcoma of left kidney.	—	Carcinoma; death from septic peritonitis.	D.	—
35	5. i, '83.	Billroth (Vienna). *Wien. Med. Woch.*, 1884, No. 25, p. 773.	F., 38	Do.	Retro-peritoneal fibroma	5 years.	Myxo-sarcoma, as large as a man's head, of the right kidney.	—	R
36	30. i. '83.	Czerny. *Jong's Statistics.*	F., 46	Do.	Multilocular ovarian cyst.	2 years.	Sarcoma of right kidney (4 lbs.); death on third day; peritonitis.	D.	—
37	2. ii. '83.	Thornton (Lond.) *Brit. Med. Jour.*, 1883, i, p. 255.	F., 53	Linea alba.	Ovarian tumour.	6 years.	Sarcoma of the capsule, weighing 7 lbs.	—	R.

NEPHRECTOMIES PERFORMED FOR TUMOURS OF THE KIDNEY—*Continued.*

No.	Date	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
38	20. ii. '83.	Gross (Phil.) *Med. News*, 1883, i.	F., 59	Linea alba.	Carcinoma of kidney (right).	3 mos.	Carcinoma; left kidney normal; death in 65 hours from peritonitis; tumour weighed 18 oz.	D.	—
39	12. vi. '83.	V. Bergmann (Berlin). *Bolz. Dissert. Dorpat*, 1883, p. 33.	F., 41	Langenbuch's.	Tumour of kidney.	9 mos.	Sarcoma; death in three days from suppression of urine and collapse.	D.	—
40	31. vii. '83.	Périer. (Brodeur.)	M., 65	Abdominal.	Cancer of right kidney.	—	Diagnosis confirmed; death from uræmia and œdema of lungs.	D.	—
41	viii. '83.	Godlee (Lond.) *Med. Times and Gazette*, 1884, ii, p. 627.	M., 2	Langenbuch's.	Tumour of kidney.	2 mos.	Sarcoma (1 lb.); recovery after operation, but in seven months death from recurrence.	—	R.
42	26. ix. '83.	V. Bergmann. *Berlin Klin. Woch.*, xlvi, 1885.	F., 54	Lumbar.	Malignant tumour of kidney (right).	—	Sarcoma; abscess formed in wound.	—	R.
43	24. xi. '83.	Homans (Boston), *Boston Med. and Surg. Jour.*, 24th Jan., '84.	M., 29	Abdominal.	Renal tumour.	2 years.	Carcinoma of left kidney (3½ lbs.); death in fifty-one hours from general peritonitis.	D.	—
44	13. xi. '83.	R. Davy (Lond.) *Brit. Med. Jour.*, 1883, ii, p. 1031.	M., 53	Lumbar.	Cystic tumour.	—	Large fibro-cystic tumour of left kidney; death 2 months after from disseminated carcinoma; calculus impacted in new growth.	—	R.
45	16. ii. '84.	Billroth (Wien). *Wien. Med. Woch.*, 1884, xxv, 774.	M., 33	Do.	Tumour of left kidney.	—	Papilloma of kidney thrice the size of closed hand.	—	R.

46	1884.	Meredith. *Med. Times and Gazette*, 1884, ii, 627.	F.	Abdominal.	Tumour of kidney.	—	Rapidly growing tumour of kidney; round-celled sarcoma, weighing 3½ lbs.; death in three days from peritonitis.	D.	—
47	23. i. '84.	Péan (Paris). *Gaz. des Hosp.*, 1885, xxxix, 307.	F., 45	Linea alba.	Tumour of kidney (right).	5 years.	Large tumour of right kidney (epithelioma?), weighing 12 lbs.	—	R.
48	20. ii. '84.	Clementi (Catania). (Private.)	F., 30	?	Sarcoma of kidney.	—	Carcinoma of kidney.	—	R.
49	26. v. '84.	Wahl. *St. Petersburger Med. Woch.*, xliv, 1885.	F., 11	Abdominal.	Fibroma of right kidney.	—	Diagnosis confirmed.	—	R.
50	4. x. '84.	Bardenheuer. (Private.)	M., 2¼	Lumbar.	Carcinoma of kidney.	—	Recovered from the operation, but died from recurrence.	—	R.
51	xi. '83.	S. Wells.	F., 48	Abdominal.	Tumour of kidney.	—	Fibro-lipoma; degeneration of kidney; recovery without complications.	—	R.
52	1884.	Chadwick. *Centralb. f. Chir.*, ix, 1885.	F.	Do.	Sarcoma around kidney.	—	Diagnosis confirmed; deep-seated abscess; no autopsy.	D.	—
53	1884.	Krönlein. *Centralb. f. Chir.*, xliii, 1885.	F., 58	Do.	Round-celled sarcoma.	—	Diagnosis confirmed.	—	R.
54	3. i. '85.	Claus (Elberfeld). *Centb. f. Chir.*, 1885, No. 24, Beilage.	F., 46	Do.	Ovarian tumour.	4 years.	Fibroma and cystic kidney; recovery from operation in four weeks.	—	R.
55	17. i. '85.	Pughe (Liverpool). *Liverpool Med. Chir.*, J. 1885.	F., 2½	Do.	Sarcoma.	2 years.	Sarcoma; death seven days after, from strangulation of loop of intestine.	D.	—
56	7. ii. '85.	Albert (Wien). *Horoch. Centb. f. Chir.*, 1885, No. 24, Beilage, p. 80.	F., 40	Lumbar.	Tumour of right kidney with pus and blood in urine.	2 years.	Carcinoma of kidney weighing 2½ lbs.	—	R.

NEPHRECTOMIES PERFORMED FOR TUMOURS OF THE KIDNEY—*Continued.*

No.	Date.	Operator and Record.	Sex and Age.	Nature of Operation.	Diagnosis of Disease.	Duration.	Diseased Condition as Ultimately Determined.	Death.	Re-covery.
57	7. ii. '85.	Croft (Lond.) *Lancet*, 1885, I. 936.	M., 3	Lumbar.	Tumour of right kidney with hæmaturia.	—	Round-celled sarcoma of right kidney; recovery in six weeks.	—	R.
58	14. ii. '85.	Czerny. *Jong's Statistics.*	M., 36	Abdominal.	Tumour of left kidney, hæmaturia.	4½ years.	Large sarcoma size of child's head in left kidney; amyloid disease; metastatic growths; death in 8 days from collapse.	D.	—
59	15. v. '85.	Orlowski. *Deutsch. Zeitschr. f. Chir.*, xxii, i, 2.	F.	Lumbar.	Cancer of right kidney (movable).	—	Diagnosis confirmed.	—	R.
60	22. vii. '85.	Wahl. *St. Petersburger Med. Woch.*, 1885, xliv.	F., 49	Abdominal.	Malignant tumour.	—	Carcinoma; great relief of symptoms.	—	R.
61	25. xii. '85.	Imlach. (Private.)	F., 25	Do.	Tumour of right kidney (strumous).	—	Sarcoma of right kidney; Recovery.	—	R.
62	1885.	König (Göttingen). *Centb. f. Chir.*, 1885, No. 24, Beilage.	Child, 2½	Do.	Tumour of kidney.	—	Myxo-sarcoma; recurrence of growth after operation.	—	R.
63	21. viii. '85.	Dandois. *Bull. de l'Acad. Roy. de Méd. de Belg.*, 1885, No. 12.	Child, 2	Do.	Sarcoma of right kidney.	4 mos.	Tumour very large; tissue resembling in many respects alveolar carcinoma.	—	R.
64	—	Schönborn (Königsberg). (*Ibid.*)	Child, 2	—	Tumour of kidney.	—	Adenoma of kidney.	—	R.
65	6. iv. '86.	Bardenheuer. (Private).	M., 3	—	Sarcoma of left kidney.	—	Diagnosis confirmed.	—	R.

66	14. iv. 86.	Cullingworth (Manchester). (Private.	F., 43	Abdominal.	Ovarian tumour.	12 mos.	Spindle-celled sarcoma growing from cortex of left kidney; central portion occupied by dark gummous fluid (4 quarts); tumour and kidney together weighed 11 lbs. 6 oz.; after removal of fluid, 1 lb. 14 oz.; upper and lower end of affected kidney normal.	—	R.
67	—	Chiene (Edin.)	—	—	Tumour of kidney.	—	Sarcoma, auria.	D.	—
68	25. vi. '86.	Terrier. (Brodeur.)	F., 36	Abdominal.	Cancer of right kidney.	—	Diagnosis confirmed; left kidney also involved.	D.	—
69	1886.	Skene Keith (Edin.) *Edin. Med. Jour.*, October, 1886.	M., 61	Do.	—	—	Encephaloid cancer of right kidney, with extension into renal vein; death in fifty hours.	D.	—
70	1886.	Skene Keith (Edin.) *Edin. Med. Jour.*, October, 1886.	F., 49	Do.	—	—	Round-celled sarcoma, adherent to intestine and abdominal wall; death from peritonitis in 6½ days.	D.	—
71	1. xi. '86.	Thiriar. *Rev. de Chir.*, i, 1888.	M., 41	Lumbar.	Sarcoma of kidney.	—	Sarcoma of right kidney weighing 610 grammes.	—	R.
72	12. i. '87.	Weir (F. W.) *Ann. Surg.*, St. Louis, 1887.	M., 35	Abdominal.	Tumour.	—	Adenoma; kidney weighed 21 oz., and measured 5 inches by 5½.	—	R.
73	4. iii. '87.	Stetter. *Beil Centralb. f. Chir.*, No. 25, 1887.	F., 51	Lumbar.	Do.	—	Carcinoma of kidney.	—	R.
74	—	Israel. *Beil Centralb. f. Chir.*, No. 25, 1887.	M., 21	Do.	Do.	—	Carcinoma of kidney.	—	R.

LIST OF CASES AND SPECIMENS, ILLUSTRATIVE OF VARIOUS MORBID CONDITIONS AND SYMPTOMS, ARRANGED AS THEY OCCUR IN THE TEXT.

DISPLACEMENTS OF KIDNEY—

- Simple displacement of the kidney without mobility, 7 *et seq.*
- Fused kidney, 9.
- Floating kidney, 14 *et seq.;* 73.
- Table of movable kidneys observed by author, 24 *et seq.*
- Movable kidneys with transitory hydronephrosis, 41 *et seq.*
- Movable kidneys causing torsion and occlusion of blood-vessels, 48 *et seq.*
- Table of nephrectomies for movable kidney, 62 *et seq.*

Hæmaturia due to calculus; catheterisation of male ureter, 84.
- Due to rupture of kidney, 88.

Renal colic in hydronephrosis, 93.

NON-INFLAMMATORY LESIONS—

Congenital hydronephrosis, 104.

Acquired hydronephrosis caused by myoma of uterus, 106.
- Caused by torsion of ureter, due to enlargement and abscess of prostate, 106.
- Caused by fibrous band, 108.
- Caused by ureter entering pelvis of kidney at acute angle, 109.
- Caused by tubercular disease of bladder, 111.
- Caused by tumour of bladder, 113.
- Caused by injury of lumbar region, 115.

Transitory hydronephrosis caused by ureter entering pelvis of kidney at acute angle, 121.
- Hydronephrosis containing 30 gallons of fluid, 123.

Solitary renal cyst, 129.

Cystic degeneration, 130; unusual size, 60 lbs., 133.

NON-INFLAMMATORY LESIONS (*continued*)—

- Renal hydatids, 135 *et seq.*
  - Renal colic caused by passage of hydatid cysts, 141.
  - Treatment of hydronephrosis by manipulation, 143, 145.
    - By tapping, 146.
    - By nephrotomy, 148.
  - Table of nephrotomies for hydronephrosis and cystic disease, 156 *et seq.*
  - Table of nephrectomies for hydronephrosis and cystic disease, 158 *et seq.*

INFLAMMATORY LESIONS—

- Pyelitis: passage of masses of bacilli, 167.
  - Calculus with piece of slate pencil as nucleus, 171.
    - With piece of wood as nucleus, 171.
    - With blood clot as nucleus, 171.
- Pyonephrosis, 179.
- Pyelonephrosis: infection by uriniferous tubules, 182.
  - Infection by lymphatics of cortex, 186.
- Purulent interstitial nephritis due to pyæmia, 191.
  - Embolus of renal artery causing abscess with bacteria, 194.
  - Impaction of foreign body in pelvis of kidney causing suppuration, 194.
- Perinephritis arising from inflammation of uterus, 197.
  - Arising after excision of rectum, 197.
  - Renal calculus giving rise to no symptoms during life, 218.
  - Table of nephrotomies for suppurative disease without calculus, 230 *et seq.*
  - Table of nephrectomies for suppurative disease without calculus, 237 *et seq.*
  - Table of nephro-lithotomies for renal calculus without suppuration, 258 *et seq.*
  - Table of nephro-lithotomies for renal calculus with suppuration, 262 *et seq.*
  - Table of nephrectomies for suppurative disease with calculus, 272 *et seq.*
- Tubercular disease of kidneys, ureters, and bladder, 285.
  - Catheterisation of female ureter in tubercular disease, 293.
  - Abdominal cyst following rupture of kidney, 306.
  - Hæmaturia from injury of urethra close to bladder simulating rupture of kidney, 309.
  - Hæmaturia from papilloma of bladder supposed to be due to injury to kidney, 312.
  - Recovery from severe laceration of kidney, 313.

INFLAMMATORY LESIONS (*continued*)—
  Penetrating wound with prolapse of kidney, 314.
  Hæmaturia absent in penetrating wound of kidney, 316.
  Abscess of kidney from abdominal injury; nephrectomy, 317.
  Wound of ureter without penetration, 319.
  Pseudo-hydronephrosis from injury, 321.
  Wound of ureter by stabbing, 324.
  Hydronephrosis from traumatic stricture of ureter, 326.
  Wound of ureter by gunshot, 327.
  Ureter obstructed by blood clot, 330.
  Rupture of kidney; nephrectomy, 333.
  Table of nephrotomies for tubercular disease, 338 *et seq.*
  Table of nephrectomies for tubercular disease, 340 *et seq.*
  Table of nephrotomies and nephrectomies for traumatic lesions, urinary fistulæ, &c., 343 *et seq.*

TUMOURS—
  Fibromata, 352, 353.
  Lipomata, 355.
  Fibro-lipomata, 355.
  Fatty transformation of kidney, 357.
  Papilloma, 358.
  Primary cancer, 363.
  Epithelioma, 368 *et seq.*
  Colloid cancer, 371.
  Secondary formations in heart, pulmonary artery, &c., following upon primary cancer of kidney, 372.
  Lymphadenoma, 376.
  Sarcomata, 381 *et seq.*
  Alveolar sarcoma, 387.
  Angio-sarcoma, 389.
  Adeno-sarcoma, 390.
  Myxo-sarcoma, 390.
  Myo-sarcoma, 392.
  Table of nephrectomies for cancer, 407.
  Table of nephrectomies for sarcoma, 407.
  Table of nephrectomies for tumours, 450.

INDEX.

Abdominal nephro-lithotomy, 432.
  nephrectomy, definition of, 5.
  tumour or abscess a cause of hydronephrosis, 107.
Abscess, perinephritic, 195.
    a result of pyonephrosis, 180.
    etiology of, 195 *et seq.*
    pathology of, 199.
    prognosis of, 216.
    to distinguish between renal swelling and, 100.
    treatment of, 244.
  of pelvic organs, a cause of hydronephrosis, 107.
Acquired hydronephrosis, 105.
  causing atrophy of renal tissue, 119.
  causes of, 105 *et seq.*
  circumstances determining size of tumour in, 116 *et seq.*
  prognosis of, 127.
  treatment of, 142 *et seq.*
Acute miliary tuberculosis of kidney, 281.
  pathology of, 281.
  with allied morbid conditions, 282.
Adenoma of kidney, 358.
Adeno-sarcoma of kidney, 390.
Age as a factor in malignant disease of the kidney, 394.
Alveolar sarcoma of kidney, 387.
Anatomy of kidney, 17 *et seq.*
Angio-sarcoma of kidney, 389.
Animals, nephrectomies on, 4.
Apparatus for estimating quantity of hæmoglobin in solution, 81.
Ascites, to distinguish from renal swelling, 99.
Aspiration of kidney, 5, 147, 419.

Bacillus, tubercular, method of detecting in urinary *débris*, 292.
Bandages and trusses for treatment of movable kidney, 58.
Benign and malignant growths of kidney, to diagnose, 397.
Bladder in tuberculosis of kidney, condition of, 284.
  symptoms in tubercular kidney, 294, 296.
Bruises and lacerations of the kidney, 304.
  causes of, 304.
  prognosis of, 313.
  results of, 305.
  symptoms of, 309.
  treatment of, 329.

Calculi, composition of, 169.
  general appearance of, 176.
  mode of formation and structure, 171.
Calculous diathesis, 172.
  pyelitis a cause of pyuria, 90.
    and tubercular disease, diagnosis between, 296.

Calculus, renal, a cause of hydronephrosis, 108.
  a cause of pyelitis, 168, 176.
  causes of, 173.
  symptoms of, 217, 224.
  prophylactic treatment of, 249.
  symptomatic treatment of, 251.
  symptoms justifying operation in, 253.
  treatment of, 247 *et seq.*
  varieties of, 221.
  with suppuration, table of nephro-lithotomies for, 262 *et seq.*
  with suppuration, table of nephrectomies for 272 *et seq.*
  without suppuration, table of nephro-lithotomies for, 258 *et seq.*
Cancer of the kidney, 359 *et seq.*
  diagnosis from sarcoma, 398.
  secondary, 361.
  primary, 361.
    colloid, 371.
    encephaloid, 362.
    epithelioma, 368.
    formations secondary to renal cancer, 372.
    mode of extension of, 366.
    scirrhus, 362.
    table of nephrectomies for, 407, 450.
Catheterisation of ureter for diagnostic purposes, 293, 414.
Cicatrix of bladder, a cause of hydronephrosis, 107.
Classification of kidney operations, 5.
  of renal and vesical calculi, 169.
  of tumours of the kidney, 348 *et seq.*
  of varieties of injuries to the kidney, 303.
Colic, renal, in calculous disease, 94 *et seq.*
Colloid cancer of the kidney, 371.
Combined abdominal and lumbar nephro-lithotomy of Thornton, 432.
Compression of ureter for diagnostic purposes, 410.
Congenital cystic disease of kidney, 141.
Congenital hydronephrosis, 104.
  causes of, 104.
Cystic disease of kidney, 128 *et seq.*
  diagnosis of, 134.
  pathology of, 131.
  symptoms of, 133.
  treatment of, 152.
  hydatid, 134.
    diagnosis of, 139.
    pathology and etiology of, 134.
    physical signs of, 139.
    symptoms of, 138.
    treatment of, 154.
Cystic disease of kidney and hydronephrosis, table of nephrotomies for, 158 *et seq.*
  table of nephrectomies for, 156 *et seq.*

DEFINITION of operative terms, 5.
Diathesis, calculous, 172.
Diagnosis between ascites and renal swelling, 99.
  benign and malignant growths of kidney, 397.
  calculous and tubercular pyelitis, 296.
  cancer and sarcoma of kidney, 398 *et seq.*
  ovarian cyst and renal swelling, 99.
  perinephritic abscess and renal swelling, 100.
  renal tumour and fluid accumulations, 397.
  suppurative nephritis and pyelonephritis, 208.
Diagnosis of cause of hæmaturia, 83.
  cystic disease of kidney, 134.
  hydatid disease of kidney, 139.
  hydronephrosis, 125.
  movable kidney, 54.
  renal swelling, 98 *et seq.*
  source of hæmaturia, 78.
  varieties of renal calculi, 221.
Diseases apt to be confused with perinephritic abscess, 213.

Diseases for which nephrectomy has been performed, and the results of abdominal, lumbar, and combined operations, 437.
  of kidney, important symptoms of, 77.
Displacements of kidney, 6.
    statistics of, 7.
    varieties of, 7.
    with acompanying abnormalities, 9.
    a cause of hydronephrosis, 109.
  of pelvic organs, a cause of hydronephrosis, 108.
Distinction between movable and floating kidney, 11.
  surgical and medical diseases of kidney, 2.
Duration and termination of pyonephrosis, 214.
  of malignant growths of kidney, 395.

ELECTRIC endoscope for illuminating bladder, 415.
Emaciation, a cause of movable kidney, 29.
Encephaloid cancer of kidney, 362.
Enlargement of prostate, a cause of hydronephrosis, 107.
Enlargements of renal origin as distinguished from other morbid conditions, 97 *et seq.*
Epithelioma of kidney, 368.
Endoscope, 415.
Etiology of acquired hydronephrosis, 105 *et seq.*
  of hydatid cysts of kidney, 134.
  of malignant growths of kidney, 393.
  of movable kidney, 17.
  of perinephritic abscess and perinephritis, 195 *et seq.*
  of pyelitis, 166.
  of pyelonephritis, 182.
  of pyonephrosis, 178.
  of suppurative interstitial nephritis, 191, 194.
  of tubercular kidney, 290.

FÆCAL accumulations, to distinguish from enlargements of kidney, 101.
Fatty transformation of the kidney, 357.
Fibromata and allied tumours of the kidney, 351.
Fistulæ, renal, the result of operations, 326.
Fistulæ, urinary, arising from traumatic causes, 328.
Fluid, character of, in hydatid disease, 140.
  character of, in hydronephrosis, 120, 122.
  character of, in various accumulations, 101.
Fluid accumulations, to distinguish from renal tumour, 397.
Floating and movable kidney, distinction between, 11, 72.
Floating kidney, causation of, 73.
Fusion of kidneys, 9.

GASTRIC disturbance in movable kidney, 38.
Generative organs, the relationship of, to movable kidney, 37.
Glandular swellings, to distinguish from enlargements of kidney, 101.
Gunshot wounds of the kidney, 315.
  of the ureter, 327.

HÆMATANGIOMA of kidney, 357.
Hæmatometer of author, description of, and uses, 82.
Hæmaturia as a sign of ruptured kidney, 87, 309.
  causes of, 84 *et seq.*
  diagnosis of source of, 78.
  from injury to the kidney, 87.
Hæmoglobin in solution, apparatus to estimate quantity of, 81.
Hæmorrhage from bladder, 79.
  from kidney, 79.
  from renal calculus, 85.

Hæmorrhage from tumour of kidney, 86.
 from urethra, 79.
Hepatic cyst and tumour, to distinguish from renal enlargement, 100.
Hydatid disease of kidney, 134.
 diagnosis of, 139.
 etiology and pathology of, 134.
 physical signs of, 139.
 prognosis of, 141.
 symptoms of, 138.
 treatment of, 154.
Hydronephrosis, 103.
 congenital, 104.
  causes of, 104.
 acquired, 105.
  atrophy of renal tissue and its causes in, 119.
  causes of, 105 *et seq.*
  circumstances determining size of tumour in, 116 *et seq.*
  obscure cases, 114.
  physical signs of, 123.
  prognosis of, 127.
  symptoms of, 124.
  treatment of, 142 *et seq.*
 table of nephrectomies for, and cystic disease of kidney, 158 *et seq.*
 table of nephrotomies for, and cystic disease of kidney, 156, 157.
 intermittent, 121.
 relapsing, 122.
 transitory, 121.

INFECTION by lymphatics in pyelonephritis, 186.
 by uriniferous tubules in pyelonephritis, 184.
Inflammation, suppurative, of kidney, 165 *et seq.*
 of kidney, pathology of, 181.
Inflammatory adhesions a cause of hydronephrosis, 108.
Injuries of the ureter, 319.
 from gunshot, 327.
Injuries of the ureter from stabbing, 324.
Injuries of the kidney, 302.
  causes of, 304.
  results of nephrectomy and nephrotomy in, 336.
Injury, influence of, in producing malignant disease of the kidney, 393.
Intermittent hydronephrosis, 121.
Irritation of bladder in tubercular kidney, 294.

LACERATION of the kidney, 304.
 causes of, 304.
 prognosis of, 313.
 results of, 305.
 symptoms of, 309.
 treatment of, 329.
Lameness often a sign of perinephritic abscess, 212.
Lateral-abdominal nephrectomy, 440.
 details of operation of, 446.
Lipomata of kidney, 355.
Lumbar nephrectomy, 5, 441.
  details of operation of, 444.
 nephro-lithotomy, details of operation of, 429.
Lymphadenoma of kidney, 376.

MALIGNANT disease of the kidney, 359.
 age as a factor in, 394.
 duration of, 395.
 influence of injury in producing, 393.
Malposition of the kidney, 6.
Manipulation as a mode of treatment in hydronephrosis, 143.
Median nephrectomy, 439.
 details of the operation of, 448.
Menstruation and its relations to movable kidney, 30.
Miliary tuberculosis of kidney, 280.
 and its associated morbid conditions, 282.
 pathology of, 281.
Movable and floating kidney, distinction between, 11, 72.

Movable kidney, 11; its synonyms, 11.
  changes in surrounding structures in, 21.
  diagnosis of, 54 *et seq.*
  etiology of, 17, 23 *et seq.*
  gastric disturbance in, 38.
  generative organs in, 37.
  menstruation related to, 30.
  nephrectomies, table of, for, 62.
  physical signs of, 51.
  preponderance in females of, 23, 26.
  relative frequency on the two sides of, table of, 32.
  statistics of, 21; and their fallacies, 20.
  symptoms of, 37.
  torsion of renal vessels in, 48, 50.
  treatment of, 57.
    by constitutional means, 59.
    by local means, 58.
    by operation, 61.
    by operation of nephrectomy, 65.
    by operation of nephrorraphy, 67.
Myo-sarcoma of kidney, 391.
Myxo-sarcoma of kidney, 391.

NEPHRECTOMIES, table of, for cancer, 407.
  for hydronephrosis and cystic disease, 158.
  for movable kidney, 62.
  for sarcoma, 407.
  for suppurative disease with calculus, 272 *et seq.*
    without calculus, 237 *et seq.*
  for traumatic lesions, urinary fistulæ, &c., 343 *et seq.*
  for tubercular disease, 300, 340.
  for tumours, 450 *et seq.*
Nephrectomy, abdominal, definition of, 5.
  details of, 439, 446.
  in hydronephrosis, 150.
  lumbar, 441.
    definition of, 5.
    details of operation of, 444.
Neprectomy, lateral-abdominal, 440.
    details of the operation of, 446.
  median-abdominal, 439.
    details of the operation of, 448.
  on animals, 4.
  suitable cases in movable kidney, 66.
  table of diseases for which nephrectomy has been performed, and the results of the lumbar, abdominal, and combined operations, 437.
Nephritis, suppurative, 190.
  causes of, 191, 194.
  pathology of, 191 *et seq.*
  treatment of, 242.
Nephro-lithotomies, table of, for renal calculus with suppuration, 262 *et seq.*
    without suppuration, 258 *et seq.*
Nephro-lithotomy, circumstances demanding, 425.
  combined operation of, of Thornton, 432.
  definition of, 5.
  lumbar, 429.
    details of the operation of, 429.
Nephrorraphy, definition of, 5.
  for movable kidney, 67.
    details of operation of, 69, 448.
  advantages of, over nephrectomy, 71.
Nephrotomies, table of, for cancer, 407.
  for hydronephrosis and cystic disease, 156, 157.
  for sarcoma, 407.
  for suppurative disease without calculus, 230 *et seq.*
  for traumatic lesions, urinary fistulæ, &c., 343 *et seq.*
  for tubercular disease, 298, 338, *et seq.*
Nephrotomy, definition of, 5.
  details of operation of, 422.
  in hydronephrosis, 148 *et seq.*
  cases for which nephrotomy is called, 421.

OPERATIONS for hydronephrosis without suppuration, table of, 151.
  for cystic disease of kidney, table of, 153.
Operations on kidney, 409.
  aspiration and puncture of kidney, 147, 419.
  catheterisation of ureter for diagnostic purposes, 414.
  compression of ureter for diagnostic purposes, 410.
  (*For the other operations, see under N.*)
Osteomata of kidney, of doubtful occurrence, 354.
Ovarian cyst, to distinguish from renal swelling, 99.

PAIN and its significance in kidney disease, 92 *et seq.*
  due to renal calculus, 94.
  in perinephritic abscess, 93.
  in pyelitis, 93.
  in tubercular kidney, 94.
Papilloma of kidney, a unique case, 358.
Parasitic cystic disease of kidney, 134.
Pathology of acquired hydronephrosis, 106 *et seq.*
  of cystic disease of kidney, 131.
  of hydatid disease of kidney, 134.
  of perinephritis and perinephritic abscess, 199.
  of purulent interstitial nephritis, 191 *et seq.*
  of pyelonephritis, 182.
  of pyonephrosis, 178.
  of tubercular pyelitis, 283.
Pelvic tumours a cause of hydronephrosis, 106, 107.
Penetrating wounds of kidney, 313.
  causes of, 314.
  diagnosis of, 317.
  symptoms of, 316 *et seq.*
  treatment of, 334.
Perinephritic abscess, a result of pyonephrosis, 180.
Perinephritic abscess, distinguished from renal swelling, 100.
  prognosis of, 216.
  symptoms of, 211.
  treatment of, 244.
Perinephritis and perinephritic abscess, 195 *et seq.*
  etiology of, 195 *et seq.*
  pathology of, 199.
  treatment of, 244, 249.
Phthisis, renal, *see* Renal.
Physical signs of hydatid disease of kidney, 139.
  of hydronephrosis, 123 *et seq.*
  of movable kidney, 51.
  of renal phthisis, 290.
Pregnancy a cause of movable kidney, 27.
Prognosis of bruises and lacerations of kidney, 313.
  hydatid disease of kidney, 141.
  hydronephrosis, 127.
  perinephritic abscess, 216.
  pyelitis, 208.
  tubercular disease of kidney, 297.
Prophylaxis against pyelonephritis, 243.
  against renal calculus, 249.
Prostatic enlargement, a cause of hydronephrosis, 107.
Pseudo-hydronephrosis arising from injury to ureter, 321.
Puncture of kidney, 5, 147, 419.
Purulent interstitial nephritis, 191.
  causes of, 191, 194.
  pathology of, 191 *et seq.*
Pyæmia, morbid condition of kidney in, 192.
Pyelitis, 166.
  calculous, 168, 176.
  effects on renal pelvis and substance, 176.
  etiology of, 166.
  symptoms of, 203.
  treatment of, 226.
  tubercular, 283.
    etiology of, 290.
    pathology of, 283.

Pyelitis, tubercular, physical signs of, 290.
    symptoms of, 294.
Pyelonephritis, 180, 189.
  causes of, 182.
  pathology of, 182.
  symptoms of, 206.
  treatment of, 242.
Pyonephrosis, 177.
  duration and termination of, 214.
  etiology and pathology of, 178.
  symptoms of, 210.
  treatment of, 228.
Pyuria, clinical significance of, 89.
  diagnosis of source of, 89 *et seq.*
  due to calculous pyelitis, 90.
  due to cystic disease, 92.
  due to tubercular disease of kidney, 91.
  of renal origin, causes of, 90.

RENAL and vesical calculi, classification of, 169.
Renal calculus a cause of hæmorrhage, 85.
  of hydronephrosis, 108.
  of pyelitis, 168, 176.
Renal calculus, 173.
  causes of, 173.
  diagnosis of varieties of, 221.
  prophylactic treatment in, 249.
  symptomatic treatment in, 251.
  symptoms justifying operation in, 252.
  symptoms of, 217, 224.
  treatment of, 247.
Renal calculus with suppuration, table of nephro-lithotomies for, 262 *et seq.*
  without suppuration, table of nephro-lithotomies for, 258 *et seq.*
Renal cancer, diagnosis of, from sarcoma, 398.
  colic in calculus of kidney, 94.
  hæmorrhage, 79.
    from tumour of kidney, 86.
Renal phthisis, 283.
    etiology of, 290.
    pathology of, 283.
    physical signs of, 290.
    prognosis of, 297.
    symptoms of, 294.
    treatment of, 298.
    table of nephrectomies for, 300, 340 *et seq.*
    table of nephrotomies for, 298, 338 *et seq.*
Renal swelling as distinguished from other morbid conditions, 97 *et seq.*
    in kidney disease, to diagnose cause of, 86.
  tumour, to diagnose from fluid accumulations, 397.
Results of injuries to kidney, 304.
Round-celled sarcoma, 384.
Ruptured kidney, symptoms of, 309.
Ruptured ureter, cases of, 317.

SARCOMATA of kidney; their varieties, 378.
  adeno-sarcoma, 390.
  alveolar sarcoma, 387.
  angio-sarcoma, 389.
  myo-sarcoma, 391.
  myxo-sarcoma, 391.
  round-celled sarcoma, 384.
  spindle-celled sarcoma, 385.
  congenital, 381.
  Dr. Windle's summary, 379.
  mode of origin and extension of, 382.
  table of nephrectomies for, 407, 450.
Scirrhous cancer of kidney, 362.
Scrofulous kidney a cause of pyuria, 91.
Simon's experiments on operations on the kidney, 4.
Spectrum as a means of diagnosis, 81.
Splenic growths, to distinguish from renal enlargements, 100.
Statistics of movable kidney, 21.
  fallacies of, 20.
Stricture of urethra a cause of hydronephrosis, 107.

Strumous disease of kidney, 283.
  etiology of, 290.
  pathology of, 283.
  physical signs of, 290.
  prognosis of, 297.
  symptoms of, 294.
  treatment of, 298.
Suppression of urine in movable kidney, 50.
  as a sign of injury to the kidney, 311.
Suppurative disease of kidney, 165 *et seq.*
  pathology of, 181.
  treatment of, 226 *et seq.*
Suppurative disease with calculus, table of nephrectomies for, 272 *et seq.*
Suppurative interstitial nephritis, 190.
  causes of, 191, 194.
  pathology of, 191 *et seq.*
  treatment of, 242.
Surgical and medical kidney, distinction between, 2.
"Surgical kidney," 180.
Swelling in renal region and its significance, 96.
Symptomatic treatment of renal calculus, 251.
Symptoms justifying operation in renal calculus, 252.
Symptoms of kidney disease in general, 77.
  of hydronephrosis, 124 *et seq.*
  of movable kidney, 37.
  of penetrating wounds of kidney, 316 *et seq.*
  of perinephritic abscess, 211.
  of pyelitis, 203.
  of pyelonephritis, 206.
  of pyonephrosis, 210.
  of renal calculus, 217, 224.
  of renal hydatids, 138.
  of ruptured kidney, 309 *et seq.*
  of tubercular pyelitis, 294.

TABLE of causes of acquired hydronephrosis, 114.
Table of causes of death in 120 cases of lumbar and abdominal nephrectomies, 442.
  diseases for which nephrectomy has been performed and the results of the lumbar, abdominal, and combined operations, 437.
  lesions for which nephrotomy has been performed and the results of the lumbar and abdominal operations, 424.
Table of nephrectomies for cancer, 407, 450.
  for hydronephrosis and cystic disease, 158.
  for sarcoma, 407, 450.
  for suppurative disease of kidney with calculus, 272.
  for suppurative disease of kidney without calculus, 237.
  for tubercular disease, 300, 340 *et seq.*
  for tumours of kidney, 450 *et seq.*
Table of nephrectomies and nephrotomies for traumatic lesions, urinary fistulæ, &c., 343 *et seq.*
Table of nephro-lithotomies for renal calculus with suppuration, 262 *et seq.*
  for renal calculus without suppuration, 258 *et seq.*
Table of nephrotomies for hydronephrosis and cystic disease, 156, 157.
  for suppurative disease without calculus, 230 *et seq.*
  for tubercular disease, 298, 338 *et seq.*
Table of operations for cystic disease, 153.
  for hydronephrosis without suppuration, 151.
Tapping as a mode of treatment for hydronephrosis, 146.
Torsion of renal vessels in movable kidney, 40, 50.
  of ureter as a cause of hydronephrosis, 107, 109.

Transitory hydronephrosis, 121.
  in movable kidney, 41.
Treatment of cystic disease of kidney, 152.
  of hydatid cysts of kidney, 154.
  of hydronephrosis, 142 *et seq.*
    by nephrectomy, 150 *et seq.*
    by nephrotomy, 148 *et seq.*
Treatment of lacerations of the kidney, 328.
  of malignant growths of the kidney, 405 *et seq.*
  of movable kidney, 57.
    by constitutional remedies, 59.
    by local means, 58.
    by operation, 61.
  of penetrating wounds of kidney, 334.
  of perinephritic abscess, 244, 249.
  of pyelitis, 226.
  of pyelonephritis, 242.
  of pyonephrosis, 228.
  of suppurative disease of kidney, 226 *et seq.*; 242 *et seq.*
  of renal calculus by operation, 255 *et seq.*
    by prophylaxis, 249.
    symptomatically, 251.
  of tubercular kidney, surgically, 298.
Tubercular bacillus in kidney disease, method of detecting, 292.
Tubercular disease of bladder, a cause of hydronephrosis, 111.
Tubercular disease of kidney, 279 *et seq.*
  statistics of, 288 *et seq.*
  chronic etiology of, 290.
    pathology of, 283.
    physical signs of, 290.
    prognosis of, 297.
    symptoms of, 294.
    treatment of, 298 *et seq.*
Tubercular pyelitis, a cause of pyuria, 91.
  and calculous pyelitis, diagnosis between, 296.
Tuberculosis, acute miliary, of kidney 280.
  pathology of, 281.
  and its associated morbid conditions, 282.
Tumours of the kidney, 347.
  adenomata, 358.
  carcinomata, 359 *et seq.*
  fibromata and allied growths, 351.
  general remarks on classification of, 348.
  hæmatangiomata, 357.
  lipomata, 355.
  osteomata, of doubtful occurrence, 354.
  papilloma—a unique case, 358.
  primary cancer, 361.
    secondary formations in, 372.
    mode of extension in, 366.
    colloid, 371.
    encephaloid, 362.
    epithelioma, 368.
    scirrhous, 362.
  lymphadenoma, 376.
  sarcomata; their varieties, 378.
    Dr. Windle's summary, 379.
    congenital, 381.
    mode of origin and extension of, 382.
    adeno-, 390.
    alveolar, 387.
    angio-, 389.
    myo-, 391.
    myxo-, 391.
    round-celled, 384.
    spindle-celled, 385.
  table of nephrectomies for, 407, 450 *et seq.*

URETER catheter of author, and method of using, 415.
  catheterisation of, for diagnostic purposes, 414.
  compression of, for diagnostic purposes, 410.
  torsion of, a cause of hydronephrosis, 107, 109.

Ureter, wound of, 319.
    causes of, 319.
    from gunshot, 327.
    from stabbing, 324.
    giving rise to pseudo-hydronephrosis, 321.
Urethral hæmorrhage, 79.
Uric acid infarction, 174.
Urinary fistulæ, 327.
Urine in pyelitis, 203.
  in pyelonephritis, 207.
  in strumous kidney, 291.
    method of detecting tubercular bacillus in, 292.
Uriseptic renal suppuration, 180.

VESICAL and renal calculi, classification of, 169.
Vesical hæmorrhage, 79.
  hypertrophy and cicatrices a cause of hydronephrosis, 107.
  irritation in tubercular kidney, 294.
  tumour a cause of hydronephrosis, 113.

WOUNDS of ureter, causes of, 319.
  by gunshot, 327.
  by stabbing, 324.
  giving rise to pseudo-hydronephrosis, 321.
  penetrating, of kidney, 313.
    cases, 314.
    diagnosis of, 317.
    symptoms of, 316.
    treatment of, 334.

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